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BULLETIN OF THE UNIVERSITY OF NEW HAMPSHIRE

UNDERGRADUATE ISSUE

The University of New Hampshire is a public institution with a long-standing commitment to equal opportunity for all. The University does not discriminate on the basis of race, color, religion, sex, age, national origin, or handicap in its recruitment and admission of students or awarding of financial aid; in the recruitment and employment of faculty and staff; or in the operation of any of its programs and activities, in accordance with all relevant federal and state laws and regulations. Inquiries concerning the application of or compliance with such laws and regulations should be addressed to the University Director of Affirmative Action.

The University is in compliance with federal guaranteed student loan regulations and will supply information about the employment of its graduates who have majored in specialized degree programs that normally lead to specific employment fields. This information may be obtained upon request from the University's Career Planning and Placement Service, which is available to all students. The University does not guarantee employment to its graduates, but their chances for employment are enhanced if they have begun career planning early in their undergraduate days.

The University provides full information pertaining to the Family Educational Rights and Privacy Act of 1974 (the "Buckley Amendment") in the annual student guide. Information also is available from the offices of the vice president for student affairs and the vice president for academic affairs. The annual student guide also contains University regulations and policy regarding student conduct.

The University assumes no liability for failure to provide or for delay in providing expected services and/or facilities when such failure arises from causes beyond the reasonable control of the University.

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For information about undergraduate admission to the University, students should contact:
**Eugene A. Savage, Dean of Admissions.**

For information about courses and academic records, students and former students should contact:
**Stephanie M. Thomas, Registrar.**

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# University Calendar 1979-80

## Summer Session 1979

May 21 to
August 17

## Semester I 1979

| | |
|---|---|
| September 2, Sunday | **9 a.m.** Residence halls open for freshmen only |
| September 3, Monday | **9 a.m.** Residence halls open for upperclass students |
| September 3-4, Mon.-Tues. | Registration |
| September 5, Wednesday | **8 a.m.** Classes begin |
| September 10, Monday | Graduate student registration |
| September 14, Friday | Last day to drop courses without $10 late drop fee |
| September 21, Friday | Last day to add courses without dean's approval and $10 late add fee; last day to choose pass/fail grading alternative |
| October 4, Thursday | Last day for partial tuition refund on withdrawal |
| October 26, Friday | Midsemester, last day to drop courses or withdraw without academic liability<br>Last day to carry more than 20 credits without surcharge |
| November 12, Monday | Veterans Day—no classes |
| November 21, Wednesday | Classes hold Monday schedule |
| November 22-23, Thurs.-Fri. | Thanksgiving—no classes |
| November 26, Monday | Classes resume |
| December 15-16, Sat.-Sun. | Reading Days |
| December 16, Sunday | Commencement |
| December 17, Monday | Semester I final exams begin |
| December 21, Friday | Final exams end; 7 **p.m.** Residence halls close |

## Semester II 1980

| | |
|---|---|
| January 13, Sunday | **9 a.m.** Residence halls open |
| January 14-15, Mon.-Tues. | Registration |
| January 16, Wednesday | Classes begin |
| January 21, Monday | Graduate student registration |
| January 25, Friday | Last day to drop courses without $10 late drop fee |
| February 1, Friday | Last day to add courses without dean's approval and $10 late add fee; last day to choose pass/fail grading alternative |
| February 13, Wednesday | Last day for partial tuition refund on withdrawal |
| March 10-14, Mon.-Fri. | Semester break |
| March 16, Sunday | **9 a.m.** Residence halls open |
| March 17, Monday | **8 a.m.** Classes resume |
| March 21, Friday | Midsemester, last day to drop courses or withdraw without academic liability<br>Last day to carry more than 20 credits without surcharge |
| May 7-8, Wed.-Thurs. | Reading Days |
| May 9, Friday | Semester II final exams begin |
| May 16, Friday | Final exams end; **7 p.m.** Residence halls close |
| May 18, Sunday | Commencement |

## Summer Session 1980

May 19 to
August 15

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The University reserves the right to modify the Calendar subsequent to printing.

# General Information

## Facts about the University

### History

The University of New Hampshire, founded in 1866 as the New Hampshire College of Agriculture and the Mechanic Arts, was among the early state institutions of higher education whose formation was made possible by federal government land grants to establish colleges to serve the sons and daughters of farming and laboring families.

First situated in Hanover as part of Dartmouth College, New Hampshire College moved to its present campus in Durham in 1893 after Benjamin Thompson, a prosperous farmer, bequeathed land and money to further the development of the College.

The College thrived in Durham, and in 1923 the state legislature granted it a new charter as the University of New Hampshire, composed of the Colleges of Agriculture, Liberal Arts, and Technology. The Graduate School was formally added in 1928. The two-year program in agriculture, which had been offered since 1895, was formally recognized in 1939 and is now the Thompson School of Applied Science. The Whittemore School of Business and Economics was established in 1962.

In 1963, the University System of New Hampshire was created when the teachers' colleges at Plymouth and Keene were brought under the same Board of Trustees as the University. In 1969, the state legislature recognized the extended functions of the College of Agriculture, renaming it the College of Life Sciences and Agriculture; and the School of Health Studies was established as part of the University's programs. Beginning in 1971, the Division of Continuing Education was authorized to offer Associate in Arts degree programs as an additional approach to higher education for New Hampshire residents. In 1975 the College of Technology was renamed the College of Engineering and Physical Sciences.

Since 1967, the University has provided a widening range of undergraduate and graduate studies through its program at the Merrimack Valley Branch in Manchester. In 1977, the legislature recognized the branch as the Merrimack Valley College, the fourth campus in the University System. In 1972, the School of Continuing Studies was created to coordinate the off-campus, educational programs of the University System institutions and to carry instructional services to communities throughout New Hampshire.

In the 1978-79 academic year, the University had 10,425 degree candidates enrolled, including 471 in the Associate in Applied Science program of the Thompson School and 164 in the Associate in Arts program in the Division of Continuing Education. In the Division of Continuing Education, 1,527 special students also were enrolled.

Academic and cultural resources of each campus are amplified through System-shared programs and facilities. Cooperative ventures among the 12 member institutions of the New Hampshire College and University Council combine public and private higher education resources.

### Campus

The home of the University is Durham, near the seacoast of New Hampshire—one of the oldest towns in northern New England. The town is semirural and still retains traces of its colonial past.

The campus, 188 acres in size, is surrounded by more than 3,000 acres of fields, farms, and woodlands owned by the University. A stream flowing through a large wooded area in the middle of the campus enhances the natural open space among the buildings—35 for teaching, research, and service, and 30 residence halls for men and women.

*University Library* houses more than 760,000 volumes, 6,000 periodicals, 7,600 tapes and records, and a substantial microfilm collection. Specialized subject collections in chemistry, engineering and mathematics, biological sciences, and physics are housed in four branches administered by a physical sciences librarian and a biological sciences librarian.

*Athletics-Physical Education facilities,* include indoor and outdoor swimming pools, a track, gymnasia, and a number of playing fields. Snively Arena, an indoor ice hockey rink, and Lundholm Gymnasium, when not in use for athletics and physical education, also provide sites for some convocations and major cultural attractions.

*Memorial Union Building* contains student activities offices, auditoria and meeting rooms, food services, games and craft areas, and lounges.

*The New England Center*, a cooperative effort by the six state universities of New England to provide outstanding continuing education programs throughout the region, is situated in Durham. Offices for several regionally oriented educational organizations are in its administration center, and its residence-dining-learning center provides modern facilities for adult education conferences and seminars.

*John S. Elliott Alumni Center*, completed in 1977, houses the alumni and development offices and serves as a focal point for alumni activities and campus meetings.

The University has a DECsystem-10 computer with a number of terminals around the campus. Students in many disciplines, including science and engineering, are given assignments which require the use of the computer.

### Teaching, Service, and Research

The University of New Hampshire is committed to offering excellent educational programs and opportunities for its students. The University's approximately 570 full-time teaching faculty provide a ratio of one full-time faculty member to about 18 full-time students. More than 75 percent of the full-time faculty hold doctoral or terminal degrees, and many have earned national and international reputations in their professional fields.

A faculty member's first responsibility is to teaching students. In the tradition of the nation's land-grant colleges, the University also encourages its faculty to contribute to the growth of human knowledge through scholarly research and service to the community beyond the campus.

### Accreditation

The University of New Hampshire is a member in good standing of the New England Association of Schools and Colleges, the major accrediting body for the University. Specialized programs of study are also accredited by various professional organizations.

## Admissions Procedure

### General Information

The admissions policy of the University is designed to admit students whose personal records, achievement, aptitude, and motivation demonstrate that they have the qualifications for carrying the desired program satisfactorily. Factors of sex, race, religion, color, age, handicap, and national origin do not enter into the admissions process.

### Interviews and Campus Visits

Candidates are welcome to contact the Admissions Office to arrange an interview with a student admissions representative. These representatives are trained to give essential information about the academic organization of the University and the criteria used by the Admissions Committee in reviewing candidates, and they are particularly well qualified to discuss student activities, living arrangements, and other important aspects of UNH life. The University welcomes visitors to the campus and encourages candidates to participate in regularly scheduled tours. Frequent Saturday morning Group Information Sessions conducted by an Admissions Office staff member and student admissions representatives are followed by guided tours of the campus. Please call the Admissions Office for further information about dates and times.

### Bachelor's Degree Candidacy

Admission to a University bachelor's degree program is based upon successful completion of a four-year secondary school program of college preparatory coursework. Primary consideration is given to academic achievement and aptitude as demonstrated by the quality of candidates' secondary school course selections, rank in class, recommendations, and the results of a College Entrance Examination Board Scholastic Aptitude Test. Consideration is also given to such related factors as personal character, leadership, initiative, and special aptitudes and talents.

#### Secondary School Course Requirements for Bachelor's Degree Candidacy

The choice of secondary school program and course selections may limit or enhance opportunities and achievements in college. Certainly, candidates are strongly encouraged to extend their knowledge and the quality of their learning skills through work in the basic academic disciplines. Most successful candidates present at least four years of English, three years of college preparatory mathe-

matics, three years of foreign language, two years of laboratory science, and two years of social science. Successful candidates have generally completed three years of study in a single foreign language or have completed more than one year of study in each of two different language areas.

Candidates are expected to pursue in greater depth those fields in which they have special interests. For example, students who plan to specialize in engineering, science, mathematics, or forestry must present four years of mathematics including trigonometry, as well as laboratory coursework in chemistry and/or physics. For students planning to major in health-related disciplines, secondary school laboratory science courses in biology and chemistry are strongly recommended.

All candidates are expected to present certain minimum course selections from secondary school in order to be eligible for admissions consideration to the bachelor's degree programs offered by the University's various schools and colleges. All candidates for bachelor's degree programs are expected to present a total of at least sixteen secondary school course units, including a minimum of four years of English, two years of college preparatory mathematics, two years of social sciences, and one year of laboratory science. Candidates for the University's College of Liberal Arts and Whittemore School of Business and Economics must also present a minimum of two years of study in a single foreign language. Candidates for the College of Engineering and Physical Sciences must, as noted above, present a background in college preparatory mathematics, including a minimum of a half year in trigonometry, as well as a year of laboratory science coursework in chemistry and/or physics.

The number of out-of-state students admitted to the University each year is limited. Candidates are asked to indicate their "prospective majors" on their application forms and will be considered for admission in competition with other out-of-state candidates applying for the same programs.

It is true that approximately 60 percent of the University students request a change in major during their undergraduate years, and approximately 90 percent of such requests are approved each year. These changes are possible after a student has been at the University for a semester and has secured permission from the appropriate college dean and department chairperson. It is important to realize that the University cannot honor all requests for such changes; at present this is true for the programs in nursing, medical technology, occupational therapy, wildlife management, and administration.

**Admissions Tests Requirements**

All candidates for admission to bachelor's degree programs are required to submit the results of a College Entrance Examination Board Scholastic Aptitude Test. While achievement tests are not required, successful scores on the Foreign Language Achievement Tests may enable an applicant to satisfy the foreign language requirement of the Bachelor of Arts degree programs. Other achievement tests are strongly recommended for candidates to the College of Engineering and Physical Sciences, the College of Life Sciences and Agriculture, and the School of Health Studies in the areas generally related to the student's prospective major.

**Art and Music Candidates**

Candidates applying for the arts major, studio option, or the Bachelor of Fine Arts program are required to submit a portfolio. There is no portfolio requirement for those entering the art history option of the arts major. Candidates applying for programs in the Department of Music must make arrangements with the department chairperson for an audition. Chairpersons of both the arts and music departments may be reached at the Paul Creative Arts Center.

**Freshman Admission Application Deadlines**

Except for Early Decision candidates, applications should be submitted only after the first marking period grades are available and, for nonresident applicants, before February 15. New Hampshire applicants must submit their applications by March 1. Applications received from New Hampshire residents after that date may be considered only as vacancies occur. A nonrefundable application fee, $10 for New Hampshire residents and $20 for nonresidents, must accompany the application.

**Early Decision**

The University encourages freshman applicants who desire fall enrollment to apply for admission under an Early Decision program designed for well-qualified students who have made UNH their first-choice school. Applicants must submit a regular application, high school record, junior-year Scholastic Aptitude Test score, and a statement countersigned by the secondary school counselor which indicates that the University of New Hampshire is the first-choice college and that other applications will be withdrawn if the candidate is admitted under Early Decision. Candidates for admission under the Early Decision program must file their applications and all supporting credentials between September 15 and December 15 and will be notified of the decision within three weeks of the receipt of application materials.

**Deferred Admission**

The University considers applicants for deferred admission, which enables students to reserve a space in college while taking time off from school for work or travel. The University may not be able to offer deferred admission in certain program areas, however.

**Advanced Standing**

The University will recognize unusual secondary school work by means of advanced placement and credit for those who have taken enriched or accelerated courses before entering college. Applicants qualify for such credit by satisfactory achievement on University-approved placement examinations, including the College Board Advanced Placement Tests, or through College Level Examination Program (CLEP). Further information may be obtained from the Admissions Office.

## Associate Degree Candidacy

The University accepts candidates for Associate in Applied Science and Associate in Arts degree programs who have demonstrated ability and motivation for learning through secondary school achievement, work experience, and/or military service.

Both New Hampshire residents and out-of-state students may be considered for admission to Associate in Applied Science degree programs offered by the University's Thompson School of Applied Science. Students admitted to the Thompson School will be eligible for University residence hall accommodations. Two of the programs offered by the Thompson School, forest technology and civil technology, require that candidates present a minimum of two years of college preparatory mathematics.

The University offers an Associate in Arts degree program through the Division of Continuing Education. This program is available only to commuting New Hampshire residents, although this rule may be waived if the applicant is a full-time employee of a New Hampshire business. Out-of-state candidates for whom this rule is waived are liable for out-of-state tuition and fees, however. (see also Associate in Arts chapter)

## Eligibility for Degree Candidacy

Applicants who meet the appropriate requirements for admission may become candidates for any undergraduate degree offered by the University. However, applicants having received one degree from any institution will not be admitted into a program of study that awards the same degree (e.g., B.A., history, B.A., zoology). Applicants may, however, be admitted into a program awarding a different degree (e.g., B.A., history, B.S., biology; or B.A., history, A.A.S., business management).

## Readmission

An undergraduate who withdraws or is suspended or dismissed from the University thereby terminates degree candidacy and must apply for readmission before the deadlines established by the Admissions Office. Before seeking readmission, suspended students must remain away from school for at least one semester. Applications submitted by suspended students are referred to the dean of the college or school to which they are applying, and evidence must be presented that they can successfully resume University work. Only under extraordinary circumstances will students be readmitted after having been dismissed for academic reasons. Applications submitted by dismissed students must be reviewed by the University's Academic Standards and Advising Committee. Students applying

for readmission should realize that it may not be possible to enroll in certain programs that have established enrollment limitations, and no assurance can be offered that University housing will be available.

### Transfer Students

The University will consider qualified candidates desiring to transfer from approved institutions. Transfer credit is awarded for courses that have been completed with a grade above the lowest passing grade, provided those courses are comparable to courses offered at the University of New Hampshire. The University encourages competent applicants who have valid and legitimate reasons for desiring a transfer to UNH; however, it cannot encourage applicants with a history of academic or personal difficulty. Students who have encountered such difficulty are usually better advised to return after an appropriate period to their former college and improve their record before attempting to transfer.

Students enrolled in one of the University's associate degree programs who desire admission to a baccalaureate degree program at UNH must apply as transfer students through the Admissions Office. A recommendation from the associate degree adviser is also required.

Transfer applicants should realize that it may not be possible to enroll in certain programs that have established enrollment limitations, and no assurance can be offered that University housing will be available.

Students desiring to transfer for the fall semester must complete application procedures before March 1; for spring semester, by November 15.

No portion of students' grade-point averages may be transferred; that is, previous grade-point averages will not be calculated in the ones earned by students at UNH.

### New England Regional Student Program

The University participates in the New England Regional Student Program of the New England Board of Higher Education, in which each state university in New England offers a number of regional curricula at the undergraduate level to students from other New England states. Under this program, students receive preferential admission consideration and, if admitted, pay in-state tuition. Students must indicate on the application their intention to apply for this reduced tuition. Information about the curricula may be obtained from the New England Board of Higher Education, 40 Grove Street, Wellesley, Mass. 02181.

### Special Student Status

UNH offers the special student classification for persons who wish to participate in University coursework without entering degree programs. Special (nonmatriculated) students register for coursework through the University's Division of Continuing Education and are usually restricted to part-time study (maximum of 11 semester hours) unless permission is granted by the Admissions Office. Special students have full access to the academic counseling services of the division and should realize that their continuing participation in University coursework is predicated upon satisfactory achievement.

### Rules Governing Tuition Rates

#### Basic Rule

All students attending any division of the University of New Hampshire in any capacity shall be charged tuition at a rate to be determined by their domicile. Those domiciled within the state of New Hampshire shall pay the in-state rate. Those domiciled elsewhere shall pay the out-of-state rate.

Students are classified as residents or nonresidents for tuition purposes at the time of admission to the University. The decisions, made by the dean of admissions, are based upon information furnished in students' applications and any other relevant information.

All applicants living in New Hampshire are required to submit a notarized statement to the effect that their parents have been legally domiciled in New Hampshire continuously for a period of at least twelve months immediately prior to registering for the term for which the students are claiming in-state status. Students admitted from states other than New Hampshire or from foreign countries are considered nonresident throughout their entire attendance at the University unless they have acquired bona fide domicile in New Hampshire.

If students maintain residency apart from that of their parents, they must clearly establish that their residence in New Hampshire is for some purpose other than the temporary one of obtaining an education at the University. To qualify for in-state status, students must have been legally domiciled in New Hampshire continuously for a period of at least twelve months prior to registering for the term for which in-state status is claimed.

The burden of proof in all cases is upon the applicants. In all cases, the University reserves the right to make the final decision concerning resident status for tuition purposes.

The University rules governing tuition rates are fully set forth on the application for admission, and all students are bound by them.

## Division of Student Affairs

The Division of Student Affairs provides a broad range of student services and programs which supplement the academic programs of the University.

Division functional areas include: the vice president for student affairs; the dean of students office; residential life, which includes dining services and residence halls; financial aid; student activities/Memorial Union; health services; counseling and testing; and career planning and placement.

The division annually publishes a student guide which includes statements of privacy rights as required by the Family Educational Rights and Privacy Act of 1974.

### Dean of Students Office

The Dean of Students Office has major responsibility for the quality of student life on campus. The staff has a working knowledge of the entire University (policies, procedures, and people) and interacts regularly with students, staff, faculty, trustees, and other persons who are interested in or involved with what is happening at UNH.

Within the Dean of Students Office, there are five specific areas of responsibility: judicial affairs, new student programs, community and student development, international student affairs, and nonacademic University policies and procedures. Students and others are encouraged to contact the Dean of Students Office whenever they have a question, concern, or problem involving University life.

### Residential Life

The University has 30 undergraduate residence halls grouped in three geographic areas on campus with a dining hall situated in each area.

Information and applications for room and board are sent to eligible new students soon after notices of admission. Acceptance to the University does not guarantee on-campus housing. Established application procedures must be followed to secure University housing.

The University reserves the right to adjust room and board charges and policies when necessary; however, such adjustments will be announced as far in advance as possible. Additional information about residence halls and dining services is available through the Office of Residential Life.

#### Residence Halls

Undergraduate University housing is limited to full-time degree candidates; Associate in Arts degree and Division of Continuing Education students are not eligible for on-campus housing. Students are not required to live on campus. University housing is not guaranteed for the full four-year undergraduate period.

The first priority for Residence Hall housing is given to entering freshmen. Housing for transfer and readmitted students is not available Semester I. However, residence hall space is generally available for Semester II.

#### Dining

University policy requires that undergraduate students living in residence halls board in UNH dining halls.

Nonresident full-time students may purchase a board plan or a thirty-five meal commuter plan. Single meals may be purchased in the dining halls or at the Memorial Union cafeteria.

The dining halls offer a broad range of menu selections, enabling the diet requirements of most students to be met. However, a student with unusually restricted menu requirements because of medical prescription or religion should inquire with Dining Services as to whether these special meals can be met.

Any request for exception to the board policy based on dietary restrictions must be made before the beginning of the semester.

## Student Activities/Memorial Union

The Office of Student Activities in the Memorial Union serves as the center for cultural events, student organizations, and related activities. It provides a wide variety of services and programs for the entire University community.

### Student Activities

Serving as a programming resource for students and other members of the community, the office provides administrative coordination for campus-wide events and operates the Memorial Union as an integral part of the University.

Students participate in approximately eighty recognized organizations, each with special interests, which include academics, politics, religions, careers, service, and social fraternities and sororities. A Student Activities Tax, determined by student government, provides funds for: *The New Hampshire*, the student newspaper; WUNH-FM, the student radio station; *The Granite*, the UNH yearbook; the Student Video Tape Organization; Student Government; Student Press; the Women's Center; and two programming organizations, the Memorial Union Student Organization (MUSO) and the Student Committee on Popular Entertainment (SCOPE). Additional funds are available on request to other organizations for special programs.

Programs range from lectures, concerts, films, and educational seminars to special events like Parents' Weekends, Homecoming, the Christmas Crafts Fair, Winter Carnival, the Memorial Union open house, and spring dances. Teaching programs emphasize skills in creative expression, leadership, and basic organization.

### Memorial Union

As the University's community center, the Memorial Union serves as the focus for student programs and provides services for the entire University community. Students, faculty, and staff on the Memorial Union governing board work with the director to set policies for the operation of the building and those student activities related to the building. Building services include the University Information Center and Ticket Office, the Cat's Closet Store, a crafts center, a scheduling office for room and facility reservations, and a food service operation consisting of a cafeteria, Pistachio's sweet shoppe, pub, and catering service. The games area on the lower level of the building has candlepin bowling lanes, pool and billiard tables, pinball machines, and table tennis tables.

## Health Services

The University Health Service in Hood House provides out- and in-patient health care, laboratory tests, X-rays, limited mental-health care, and routine medications. For serious medical problems, students are generally referred to specialists and/or a local hospital. An emergency ambulance service is available at all times.

During the regular academic year, Hood House is staffed by full-time physicians, adult registered nurse practitioners, nurses, and part-time consultants. Appointments with physicians may be made upon request. An appointment is not necessary for medical problems requiring immediate attention, and such cases will be treated through the outpatient clinic on a walk-in basis.

There is a charge for all health services. Eligible full-time students may enroll in a prepaid health plan (Student Health Fee) or pay a fee for all services rendered at the student health center. Prepayment of the Student Health Fee entitles students to most of the outpatient services available in the student health center at no additional charge. Inpatient care, consultation with specialists, inpatient and outpatient care at other hospitals and clinics, and medicines for chronic illnesses are not covered by the health fee. An optional student accident and sickness insurance policy, available at a moderate cost, covers all of these items except medicines and is an economical means of assuring proper medical care. Most Hood House charges are not covered by Blue Cross/Blue Shield because of its classification as an institutional infirmary. Student insurance may supplement or replace other insurance but is best purchased in conjunction with the Student Health Fee. Services covered by the health fee are not covered by the accident and sickness insurance policy, or vice versa.

### Health Record Requirement

In order to provide effective health service, the University requires that students who have been formally accepted for bachelor's or associate degree candidacy and who register for nine or more semester credit hours must have complete

medical records on file with the University Health Service. These records consist of a special health form furnished before registration. Students wishing exemption from this requirement on religious grounds must make a written request to the medical director of the University Health Service. It is the responsibility of students to complete the form before the beginning of classes. Any students failing to submit the completed form will not be allowed to register for classes in the subsequent semester.

### Counseling and Testing Center

The Counseling and Testing Center offers students, without charge, professional counseling assistance in meeting a variety of personal, educational, and vocational problems. Services include individual and group counseling, vocational testing, and information on national testing programs such as the Graduate Record Examination. Individual clinical testing is available when indicated.

The staff is committed to the welfare and development of UNH students. The center sponsors a variety of student-oriented activities; e.g., personal skills groups on such topics as communication, values clarification, and life planning. The staff is available for consultation with faculty, administrative staff, and parents on matters relating to the welfare of students.

All information about a student's visits to the Counseling and Testing Center is confidential and cannot be released to anyone without the permission of the student.

### Career Planning and Placement Service

The Career Planning and Placement Service assists students in planning for careers. The assistance available to students includes: an on-campus interview program, which brings recruiting personnel to the campus between November and April; a library of information on employers and career opportunities; vocational counseling; and aid in finding summer employment. The service is available to all undergraduates; early use is encouraged.

#### College Council Placement Office

The College Council Placement Office (CCPO) is a student service program funded by the New Hampshire College and University Council, of which UNH is a member. Students are encouraged to take advantage of this supplementary resource. The CCPO may be contacted directly at its Manchester, New Hampshire, office or through the University's Career Planning and Placement Service.

## Financial Aid

The University Financial Aid Office assists promising students who are unable to meet educational expenses entirely from their own family resources. Aid is available in the form of grants and scholarships, loans, and part-time employment. The financial aid issue of the *Bulletin of the University of New Hampshire* contains specific program information, and a financial aid brochure gives application procedures and deadlines.

In many communities, scholarships and loans are available locally. School principals and guidance counselors have information about these sources of assistance, which are available both to high school seniors and adult students.

Before applicants may be considered for assistance by the University, two forms must be submitted: the UNH Application for Financial Aid and the Financial Aid Form. New Hampshire applicants may obtain these forms from their high school or from the UNH Financial Aid Office. Nonresidents and transfer students may obtain the UNH application form from the Financial Aid Office and the Financial Aid Form from that office or from their local high schools. Upperclass applicants may obtain both forms from the Financial Aid Office.

Students must meet the following deadlines and should not wait until being admitted to the University before applying for financial aid:

**Undergraduate Students:** February 1
**Graduate Students:** May 1

### Grants and Scholarships

Admitted undergraduate degree candidates who will attend UNH on a full- or part-time basis may be considered for in-state tuition grants and University scholarships. Nonresidents are eligible for similar assistance. The basic consideration is financial need, although some scholarships are awarded on the basis of scholastic attainment, participation in extracurricular activities, or meeting specific requirements of a donor.

The University participates in the federally sponsored Supplemental Educational Opportunity Grant Program, which is designed to assist students of exceptional need who are admitted degree candidates attending on at least a half-time basis.

**Basic Educational Opportunity Grant Program**

Students may apply directly to the federal government for a Basic Educational Opportunity Grant by utilizing the appropriate Basic Grant section of the Financial Aid Form or by completing a separate application available in the Financial Aid Office or from high school guidance counselors. Basic grant recipients must reapply each year for a grant.

### Loan Programs

Three loan funds are administered by the University: UNH Loan Fund, National Direct, and Nursing Student Loans. Admitted undergraduate and graduate degree candidates who will attend the University on a full- or part-time basis may be considered for these loans. According to federal law, nursing loans are available only to full-time students. Financial need must be clearly demonstrated, and loans may be used only for educational expenses.

Many states now have higher education loan plans established by the Higher Education Act of 1965. Contact your local bank or other lender for information about these loans.

### Part-time Employment

The College Work-Study Program, both academic year and summer, assists students who, as determined by the Financial Aid Office, need financial assistance for their educational expenses. Admitted undergraduate and graduate degree candidates attending on at least a half-time basis are eligible for consideration.

Students who do not qualify for the College Work-Study Program may find part-time employment on or near campus.

## Fees and Expenses

The cost for the freshman year at the University averages about $3,400 for residents of New Hampshire and about $5,800 for nonresidents.

### Tuition

Tuition is $1,150 ($3,500 for nonresidents) per academic year. Undergraduates registering for 12 credits or more per semester pay the full tuition.

Students are permitted to enroll for more than 20 credits only with the approval of their college or school dean. After midsemester, persons carrying more than 20 credits will be billed a per-credit fee of $35 for each credit above 20 for resident students and $110 for nonresident students. (No refund will be made if students subsequently drop a course, bringing them to 20 or fewer credits.) Resident undergraduates registering for fewer than 12 credits pay $35 per credit hour, plus a registration fee of $5 per semester. Nonresident undergraduates registering for fewer than 12 credits pay $110 per credit hour, plus a registration fee of $10 per semester. The minimum charge for any recorded course is $35 for residents and $110 for nonresidents.

All students who are admitted to the University must pay an advance deposit—$50 for residents and $100 for nonresidents—plus a nonrefundable fee (freshmen—orientation; transfers—administrative). Only the deposit will be credited on the tuition bill. If students decide not to attend the University, these payments will automatically be forfeited.

Three-fourths of tuition charges will be refunded to students withdrawing or dropping courses within one week of registration; one-half after one week and within 30 days; and none thereafter. (See University Calendar, page 3.) A degree candidate who withdraws from UNH and subsequently enrolls as a special student within the following year will be billed for tuition and fees on the same basis as degree candidates. Students with outstanding financial obligations to the University must clear their accounts before their registration will be confirmed.

A $10 fee must be paid by all students dropping courses after the first two weeks of classes. The $10 fee will not be charged to persons changing to a reduced load or withdrawing; in both of these cases, the regular tuition rebate policy will apply. A $10 fee will also be assessed for courses added after the three-week add period. The occasional students who register very late (after the add period) will be assessed the $10 fee for each course that is registered for

after the deadline. A change of section (within the same course) is accomplished by a "drop" of one section and an "add" of another section. The fee will not be assessed for the add portion of the late section change. The $10 drop fee will still apply for the drop portion of a late section change.

### Fees

Fees (1978/79) are: Memorial Union fee, $35; recreation/physical education fee, $30; student services fee, $10; and a student activity tax of $24.70, which includes a subscription to the student newspaper and yearbook and membership in Student Union, Student Government, and class activities. These fees cover the academic year. Degree candidates registered for less than 12 credits are charged the preceding mandatory fees on a prorated basis.

An optional student season-athletic ticket may be purchased for $20. Optional student insurance for $55 is available to full-time degree candidates. Participants in intercollegiate athletics are required to purchase the student health insurance.

There are no refunds of these fees. Any amount owing to the University will be deducted from any rebate due to a student.

### Room and Board

Housing charges average $750 per academic year.

Students applying for a room on campus must include a $50 prepayment fee with the housing application. Written notification of cancellation of the room application or assignment received before August 15 will result in forfeiture of the fee. Written notification of cancellation after August 15 and before closing Registration Day will result in a charge of one-fourth of the full semester's room rent. If students fail to occupy assigned rooms by one day after Registration Day, their Room Contracts will be cancelled and the students charged for one-half of the full semester's rent. Written notification of cancellation of room received by the Office of Residential Life after Registration Day and within 30 days from Registration will result in the students' being charged for one-half ot the full semester's rent. For cancellation of room 30 days or more after Registration, students will be charged for the full semester's rent.

Refunds on meal tickets will be granted only on approved waivers or withdrawal from the University. Cancellation of a meal plan before Registration Day will result in a 100 percent refund; after Registration Day but before the end of the first week of the semester, 75 percent refund; and after the end of the first week but before the end of the fourth week, 50 percent refund. Refunds after the fourth week through the end of the twelfth week will be based on the remaining food cost portion of the meal plan. No refunds will be made after the end of the twelfth week. Generally, rebates will not be allowed for missed meals except in the case of illness.

### Deposits

Refundable deposits may be required to cover locker keys or loss or breakage in certain departments. A charge will be made for individual lessons in music, as noted in the description of applied music courses. A charge will be made for riding lessons and SCUBA, as noted in the sections on physical education and animal sciences, and for field trips of the Thompson School, the Institute of Natural and Environmental Resources, and home economics. For certain courses, there are also lab fees.

### Other Expenses

Books and classroom supplies cost approximately $175. These may be purchased at the University Bookstore.

Personal expenses average $450. These will vary with the needs of individual students, and include clothing, laundry, recreation, incidentals, and travel.

### Payment

All bills, including those for room and board in University buildings, are due and payable in full on or before Registration Day for each semester.

Parents and students who wish to make periodic payments should consult their local banks or other financial institutions that provide programs for budgeting educational expenses.

| Fees and Expenses (1978-79) | Residents | Nonresidents |
|---|---|---|
| Tuition | $1,150.00 | $3,500.00 |
| Room (average) | 750.00 | 750.00 |
| Board (19 meals/wk.) | 750.00 | 750.00 |
| Activity tax | 24.70 | 24.70 |
| Recreational/physical education fee | 30.00 | 30.00 |
| Memorial Union fee | 35.00 | 35.00 |
| Student services fee | 10.00 | 10.00 |
| Books, class supplies | 175.00 | 175.00 |
| Total | $2,924.70 | $5,274.70 |
| Individual expenses | 450.00 | 450.00 |
| Athletic admissions ticket (optional) | 20.00 | 20.00 |
| Health insurance (optional) | 55.00 | 55.00 |
| Health fee (optional) | 20.00 | 20.00 |

## Reserve Officers Training Corps Programs

The Army and Air Force offer Reserve Officer Training Corps (ROTC) programs for men and women leading to a commission as a second lieutenant in their respective services. Students in either ROTC program may pursue any University curriculum that leads to a baccalaureate or higher degree.

Two- and four-year programs are available. The four-year program is open to freshmen and to transfer students who began ROTC at another institution. In addition to on-campus ROTC course requirements, students must attend an officer preparatory training session for a part of one summer.

Two-year ROTC programs are open to students who have two academic years of study remaining at the University. Applicants for the two-year program must attend a six-week training session during the summer immediately before their entry into ROTC.

ROTC scholarships are offered on a competitive basis by both the Army and Air Force. Entering freshmen may compete for four-year scholarships during the last year of high school. Students in a four-year ROTC program and two-year program applicants compete for scholarships covering their remaining academic years. Scholarships pay full tuition, all mandatory University fees, and required textbooks for all courses. In addition, all scholarship recipients receive a tax-free $100-per-month subsistence allowance. Nonscholarship students in the last two years of an ROTC program also receive the tax-free $100-per-month subsistence allowance.

Students in Air Force ROTC who are qualified for pilot training are provided civilian flight instruction.

More specific information about ROTC programs may be obtained by contacting the professor of military science (Army ROTC) or of aerospace studies (Air Force ROTC).

# University Academic Requirements

To be graduated from the University of New Hampshire, students must fulfill three types of requirements: University (General Education), degree, and major requirements.

Students will be held responsible for all work required for graduation and for the scheduling of all necessary courses. All newly matriculated students are expected to take courses to fulfill the General Education Requirements as soon as possible in their University career.

## General Education Requirements

In addition to the particular requirements for specific degrees, all candidates for a bachelor's degree must successfully obtain a passing grade in a minimum of 128 credits in courses numbered 400-799, must maintain a cumulative grade-point average of at least 2.00 for all courses taken at the University in which a grade is given, and must successfully meet the following General Education Requirements:

### Group I

Four courses, each of which must carry at least three credits, from the physical sciences and mathematics area and from the biological sciences area. Students must select at least one course from each of these areas.

### Group II

Six courses, each of which must carry at least three credits, from the arts and humanities area and the social sciences area. Students must select at least two courses from each of these areas.

### Group III

Six courses, one of which may be Engl 401 (required for graduation), and each of which must carry at least three credits, from all courses offered by the University, including those in Groups I and II.

Courses that may be used to meet Group I and Group II requirements are approved by the Calendar and Curriculum Committee of the University Academic Senate each spring for the following academic year. Students should refer to the "Academics" section of the student guide, *Caboodle*, or consult with their advisers regarding courses acceptable for satisfying the General Education Requirements.

The University, college, or department may prescribe up to eight of the sixteen courses used to satisfy the General Education Requirements. At least eight courses are to be freely elected by students. Courses taken to satisfy General Education Requirements may not be in students' declared majors. Thompson School courses taken by regularly matriculated students will not satisfy General Education Requirements except in specified cases in certain approved programs.

Engl 401 (freshman reading and composition) is required of all undergraduates and may not be used to satisfy the arts and humanities area General Education Requirment.

## Grades and Honors*

### Grades**

Instructors assign grades as listed below; grade points per semester hour are indicated in parentheses.

| | | |
|---|---|---|
| **A** | (4.00) | exceptional: outstanding to extraordinary acheivement |
| **A-** | (3.67) | intermediate grade |
| **B+** | (3.33) | intermediate grade |
| **B** | (3.00) | superior |
| **B-** | (2.67) | intermediate grade |
| **C+** | (2.33) | intermediate grade |
| **C** | (2.00) | satisfactory, competent |
| **C-** | (1.67) | marginal grade |
| **D+** | (1.33) | marginal grade |
| **D** | (1.00) | marginal grade |
| **D-** | (0.67) | marginal grade |
| **F** | (0.00) | **failure:** academic performance so deficient in quality as to be unacceptable for credit |
| **Cr** | | **credit:** given in specific courses having no letter grades, designated Cr/F |
| **P** | | passing grade in a course taken under the pass/fail grading alternative |
| **IC** | | grade report notation for incomplete course |
| **IA** | | indicates "incomplete" in a continuing course or thesis; where appropriate, the grade earned will replace "IA" assigned in previous semesters |
| **IX** | | grade not reported |

Students earning a semester or cumulative grade-point average less than 2.00 are placed on "academic warning."

*The University reserves the right to modify grading and honors practices.

**On April 3, 1978, the Academic Senate passed the following motion regarding grades: "The Academic Senate recognizes that grade inflation exists at the University of New Hampshire. The Senate, therefore, states that throughout this University the grade of C shall indicate competent, accept-

### Honors

Students who complete a semester with at least 12 semester hours and whose grade-point averages are 3.00 or higher for the semester are designated as honor students for the following semester. These categories will be used: 3.00 to 3.49, honors; 3.50 to 3.69, high honors; 3.70 to 4.00, highest honors. Seniors who have earned honors for their entire college work will be graduated with the honors earned. This policy currently is under review and may be changed.

### Pass/Fail

While earning a bachelor's degree, students may choose the pass/fail grading alternative: a) for a maximum of 16 credits during their matriculation; b) for a maximum of 4 credits per semester; c) in courses *other than* major requirements, optional minor requirements, Engl 401, and Group I and II requirements.

For B.A., B.F.A., and B.M. candidates, the pass/fail alternative is not permitted in courses that are used to meet the foreign language requirement. The minimum passing grade for credit is a D- (0.67); any grade below this minimum is a fail. All grades will be recorded on the grade roster as A, B, C, D, F, or intermediate grades. The pass/fail marks will be placed on students' transcripts and grade reports by the Registrar's Office. The course will not be included in the grade-point calculation, but the pass or fail will be recorded, and in the case of a pass, the course credits will be counted toward degree requirements.

Students may not use the pass/fail alternative to repeat a course. Associate in Arts students, see page 99.

## Degree Requirements

Information and requirements in this catalog apply to students who enter the University between July 1, 1979, and June 30, 1980. (Students who entered the University at an earlier time but who wish to change to the requirements of this catalog must apply to the appropriate office for the change.)

Modifications tend to occur in major programs during the four-year period of students' undergraduate careers. Students are expected to conform to these changes insofar as they do not represent substantive alterations in their course of study.

### Bachelor of Arts

**1.** At least 128 credits with a minimum cumulative grade point average of 2.00 in all courses completed at the University of New Hampshire.

**2.** Completion of the University General Education Requirements. This is intended to insure that all students receiving the Bachelor of Arts degree acquire reasonable exposure to and learning in the arts and humanities, social sciences, and natural sciences.

**3.** Proficiency in a foreign language at the level achieved by satisfactory work in a one-year, college-level course. This requirement may be fulfilled by achieving a score of 500 or better on a College Board foreign language achievement test, or by completing a full-year elementary course in any foreign language, or by completing a semester of a course in a foreign language beyond the elementary year. This requirement must be satisfied by the end of the sophomore year.

**4.** Satisfaction of major requirements by completing at least 32 credits of major coursework with grades of C- or better and a grade-point average of 2.00 or better. A major may require a senior paper or project and/or a comprehensive examination.

### Associate in Arts

**1.** Completion of at least 64 credit hours with a minimum grade-point average of 2.00 based on a 4.00 scale.

**2.** Completion of General Education Requirements as follows:

**Group I** Two courses, each of which must carry at least three credits, from the following areas:

a. biological sciences
b. physical sciences and mathematics

---

able performance and learning in undergraduate courses; the grade of B shall indicate superior performance and learning; the grade of A shall indicate excellent performance and learning. These standards shall apply equally to all undergraduate courses, instructors, departments, subjects and, colleges."

**Group II** Three courses, each of which must carry at least three credits, from the following areas:

c. arts and humanities

d. social sciences

Students are required to elect at least one course each in both c and d.

**Group III** Three courses, one of which may be freshman English (required for graduation) and each of which must carry at least three credits, from all courses offered by the University, including those in Groups I and II.

Courses that may be used to meet Group I and Group II requirements are approved by the Calendar and Curriculum Committee of the University Academic Senate each spring for the following academic year. Students should refer to the "Academics" section of the student guide, *Caboodle,* or consult with their advisers regarding courses acceptable for satisfying the General Education Requirements.

The Division of Continuing Education may prescribe up to four of the eight courses used to satisfy the General Education Requirements. A minimum of four courses is to be freely elected by the student. Courses taken to satisfy General Education Requirements may not be in the student's declared career option.

A University freshman English course in reading and composition (English 401) is required of all undergraduates. The freshman English course may not be used to satisfy the arts and humanities requirement in general education.

**3.** The remaining courses or credits may be earned in a career option and/or in elective general education courses.

**4.** The last 16 hours of credit must be completed through the Division of Continuing Education at UNH following admission and matriculation, unless permission is granted to transfer part of this work from another institution.

## Dual Degrees

### General Policy

The opportunity to pursue simultaneously two undergraduate degrees enhances and broadens the education of certain students. The program is only for those students who can adequately handle the requirements for two different degrees and who can reasonably allocate the additional time and effort needed for the program.

### Requirements

**1.** Students desiring dual degrees must petition the college dean or deans involved for permission.

**2.** Students planning to take one degree in a highly prescribed curriculum should register as freshmen in the appropriate school or college for that curriculum.

**3.** It is expected that candidates for two degrees will complete 32 credits beyond those required for the first degree.

**4.** The two degrees, as awarded by the University of New Hampshire, must be different (e.g., B.A. and B.S., or B.S. and B.S. in Chemistry). Transfer students already holding a baccalaureate degree from another accredited institution may pursue an additional baccalaureate degree at the University of New Hampshire provided they fulfill the previously listed requirements. The degree received at the first institution will be accepted by UNH as awarded by that institution.

### Supervision

As soon as a student is accepted as a candidate for two degrees, the appropriate dean(s) will appoint supervisors for each of the proposed majors. The supervisors and the student will work out a basic course plan for the two degrees and inform the appropriate dual degree dean(s) of the plan. The supervisors will maintain joint control over the student's academic program. The college offices and the supervisors will receive copies of grade reports and other records for students pursuing two degrees.

## Student-Designed Majors

See page 92 for requirements for a student-designed major.

## Second Majors

Students may choose to fulfill the requirements of two dissimilar major programs, provided they obtain the approval of their principal adviser and the dean(s) of the college(s) in which the programs are offered, and comply as follows:

**1.** If the two majors are offered in different schools or colleges within the University, the admissions requirements of each must be satisfied.

**2.** If the two majors have two distinct degrees, e.g., B.A., B.S., or some other designated degree, students must choose which of the two is to be awarded and fulfill all requirements for that degree.

**3.** No more than eight credits used to satisfy requirements for one major may be used as requirements for the other major.

### Minors

Students may earn a minor in any undergraduate discipline designated by the University. A list of minors is available from the advising coordinator in each college or school. Students must consult with the major adviser and the minor supervisor. A minor consists of 20 semester hours with C- or better and a 2.00 grade-point average in courses that the minor department approves. Courses taken on the pass/fail basis may not be used for a minor. No more than eight credits used to satisfy major requirements may be used for the minor. Students should declare an intent to earn a minor as early as possible and no later than the end of the junior year. During the final term, an application should be made to the dean to have the minor shown on the transcript.

Bachelor's degree students interested in obtaining a minor or concentration in a career option offered by the Division of Continuing Education should see page 100.

### Minimum Graduation Average

A cumulative grade-point average of 2.00 is the minimum acceptable level for undergraduate work in the University and for graduation. The Academic Standards and Advising Committee examines the records of students periodically and may place academically deficient or potentially deficient students on warning, or may exclude, suspend, or dismiss those who are academically deficient.

### Quota of Semester Credits

Students registering for more than 20 credits must receive the approval of the college dean.

Undergraduates are assigned class standing on the basis of semester credit hours of academic work completed with a passing grade, as follows: to be a sophomore—26 credit hours; to be a junior—58 credit hours; to be a senior—90 credit hours.

### Residence

Students who are candidates for a bachelor's degree must attain the last one-quarter of total credits for the degree in residence unless granted permission by the Academic Standards and Advising Committee to transfer part of this work from other accredited institutions.

### Withdrawal from the University

Students who leave the University are expected to file formal withdrawal notification with the registrar.

# Abbreviations

### Department Abbreviations

The following abbreviations are used to identify undergraduate and graduate disciplines offered at the University. An asterisk preceding the letters identifies those disciplines in which graduate programs are offered.

### College of Liberal Arts

| | |
|---|---|
| Anth | Anthropology |
| Arts | The Arts |
| Biol | Biology |
| Clas | Classics |
| *Educ | Education |
| *Engl | English |
| Fren | French |
| Geog | Geography |
| *Germ | German |
| Grek | Greek |
| *Hist | History |
| Huma | Humanities |
| Ital | Italian |
| Latn | Latin |
| Ling | Linguistics |
| *Micr | Microbiology |
| *Musi | Music |
| *MuEd | Music Education |
| Phil | Philosophy |
| *Polt | Political Science |
| *Psyc | Psychology |
| Russ | Russian |
| ScSc | Social Science |
| S S | Social Service |
| *Soc | Sociology |
| *Span | Spanish |
| ThCo | Theater and Communication |
| W S | Women's Studies |
| *Zool | Zoology |

### School of Health Studies

| | |
|---|---|
| Comm | Communication Disorders |
| HAP | Health Administration and Planning |
| MedT | Medical Technology |
| Nurs | Nursing |
| O T | Occupational Therapy |
| *PhEd | Physical Education |
| RecP | Recreation and Parks |
| SHS | School of Health Studies |

### Whittemore School of Business and Economics

| | |
|---|---|
| *Admn | Administration |
| *Econ | Economics |
| Hotl | Hotel Administration |
| Secr | Secretarial Studies |

### College of Life Sciences and Agriculture

| | |
|---|---|
| *AnSc | Animal Sciences |
| *Bchm | Biochemistry |
| *Bot | Botany and Plant Pathology |
| *Ento | Entomology |
| *FoRs | Forest Resources (INER) |
| *HEc | Home Economics |
| *Hydr | Hydrology (INER) |
| *INER | Institute of Natural and Environmental Resources |
| *OcEd | Occupational Education |
| *PlSc | Plant Science |
| *REco | Resource Economics (INER) |
| *Soil | Soil Science (INER) |

### College of Engineering and Physical Sciences

| | |
|---|---|
| *ChE | Chemical Engineering |
| *Chem | Chemistry |
| *CiE | Civil Engineering |
| *C S | Computer Science |
| *ESci | Earth Sciences |
| *E E | Electrical and Computer Engineering |
| E T | Engineering Technology |
| *Math | Mathematics |
| *M E | Mechanical Engineering |
| *Phys | Physics |
| *Engr | Engineering Ph.D. |
| Tech | Technology (nondepartmental) |

### Separate Departments and Programs

| | |
|---|---|
| Aero | Aerospace Studies |
| DCE | Division of Continuing Education (all courses) |
| *Gen | Genetics Program |
| Inco | Intercollege |
| Milt | Military Science |
| SOCS | School of Continuing Studies |
| TSAS | Thompson School of Applied Science |

# Degrees and Major Programs of Study

## College of Liberal Arts

**The teacher education** division of the College of Liberal Arts coordinates the five-year graduate/undergraduate teacher education program. See page 23.

**Bachelor of Arts**

Anthropology
The Arts
- Art Studio
- Art History

Classics
Communication
English
English Teaching
French
Geography
German
Greek
History
Humanities
Latin
Linguistics
Microbiology
Music
- Music History
- Performance Study
- Music Theory
- Preteaching

Philosophy
Political Science
Psychology
Social Service
Sociology
Spanish
Theater
Zoology

**Bachelor of Fine Arts**

**Bachelor of Music**

- Piano
- Organ
- Voice
- Strings, Woodwind, Brass, or Percussion
- Theory
- Music Education

**Bachelor of Science**

Biology

## College of Life Sciences and Agriculture

**Bachelor of Arts**

Botany and Plant Pathology
Entomology

**Bachelor of Science**

Animal Sciences
- Animal Sciences
- Preveterinary Medicine

Biochemistry
Biology
Botany and Plant Pathology
Entomology
General Studies
Home Economics
- Child-Family Studies
- Consumer Studies
- Home Economics Education
- Human Nutrition and Dietetics

Occupational Education
Plant Science
- Science
- General

(within the Institute of Natural and Environmental Resources)
- Community Development
- Environmental Conservation
- Hydrology
- Resource Economics
- Soil Science
- Wildlife Management

**Bachelor of Science in Forestry**

(within the Institute of Natural and Environmental Resources)
Forest Resources
- Forest Management
- Forest Science
- Wood Science
- Quantitative Science

## Thompson School of Applied Science

**Associate in Applied Science**

Applied Animal Science
Applied Business Management
Applied Plant Science
Civil Technology
Food Services Management
Forest Technology

## College of Engineering and Physical Sciences

**Bachelor of Arts**

Chemistry
Chemistry and Physics Teaching
Earth Science Teaching
Geology
Mathematics
Physics
Science

**Bachelor of Science**
Chemical Engineering*
  Energy
  Environmental Engineering
Chemistry*
Civil Engineering*
  Environmental Engineering
  Constructed Systems
Computer Science*
Electrical Engineering*
  Computer Engineering
  Electrical Engineering Systems
  Electrical Engineering Science
Geology*
Mathematics*
Mathematics Education*
  Elementary
  Secondary
Mathematics (Interdisciplinary)
  Mathematics—Chemistry
  Mathematics—Computer Science
  Mathematics—Economics
  Mathematics—Electrical Science
  Mathematics—Fluid Dynamics
  Mathematics—Mechanics
  Mathematics—Thermodynamics
  Mathematics—Physics
Mechanical Engineering*
  Energy
Physics*

**Bachelor of Engineering Technology**
Electrical Engineering Technology
Mechanical Engineering Technology

## Whittemore School of Business and Economics

**Bachelor of Arts**
Economics

**Bachelor of Science**
Administration
Hotel Administration

## School of Health Studies

**Bachelor of Science**
Communication Disorders
Health Administration and Planning
Medical Technology
Nursing
Occupational Therapy
Physical Education
  Teacher Certification
  Athletic Training
  Exercise Specialist in Health Maintenance
  Pre-Physical Therapy
  Sports Communication
Recreation and Parks
  Recreation and Administration
  Park Management

## Division of Continuing Education

**Associate in Arts in General Studies**
Career Options:
  Accounting
  Banking
  Craftsmanship—Stringed Instruments
  Criminal Justice
  Insurance
  Library Science
  Management
  Merchandising
  Quality Control
  Real Estate
  Secretarial Studies
  Traffic and Distribution Management

## The Graduate School

**Master of Arts**
**Master of Science**
**Master of Arts in Teaching**
**Master of Business Administration**
**Master of Education**
**Master of Occupational Education**
**Master of Public Administration**
**Master of Science for Teachers**
**Certificate of Advanced Graduate Study**
**Doctor of Philosophy**

## Five-Year Degree Programs

Bachelor of Arts and Master of Business Administration
Bachelor of Science and Master of Business Administration
Bachelor of Arts and Master of Education

## Interdisciplinary Minors**

Biomedical Systems and Instrumentation
Environmental Engineering
International and Foreign Area Studies
Ocean Engineering
Oceanography
Women's Studies

## Advisory Committees

Genetics
Interdepartmental Biology
Prelaw
Premedical-Predental

*Designated degree
**For other interdisciplinary programs, see pages 92-95.

# College of Liberal Arts

Allan Spitz, Dean
Melville Nielson, Associate Dean
James A. Smith, Associate Dean
Judith M. St. Lawrence,
Acting Assistant Dean
Donna B. Brown, Assistant to the Dean
George T. Abraham, Academic Counselor
Robin O. Mellin, Academic Counselor

## Divisions and Departments

**Biological Science Division**

Microbiology Department
Zoology Department

**Humanities Division**

Ancient and Modern Languages and Literatures Department
The Arts Department
English Department
Music Department
Philosophy Department
Theater and Communication Department

**Social Science Division**

Geography Department
History Department
Political Science Department
Psychology Department
Social Service Department
Sociology and Anthropology Department

**Teacher Education Division**

Education Department

## Programs of Study

**Bachelor of Arts**

Anthropology
The Arts
- Art Studio
- Art History

Classics
Communication
English
English Teaching
French
Geography
German
Greek
History
Humanities
Latin
Linguistics
Microbiology
Music
- Music History
- Performance Study
- Music Theory
- Preteaching

Philosophy
Political Science
Psychology
Social Work
Sociology
Spanish
Theater
Zoology

**Bachelor of Science**

Biology

**Bachelor of Fine Arts**

**Bachelor of Music**

- Piano
- Organ
- Voice
- Strings, Woodwind, Brass, or Percussion
- Theory
- Music Education

## General Information

### Purpose and Objectives

It is the purpose of the College of Liberal Arts, as a center of learning and scholarship, to help students achieve an understanding of the heritage of civilization and to educate them in the tradition of the past and realities of the present so that they may recognize and act upon their obligations to the future.

The college seeks to meet the educational needs of each student through the development of interests and skills which, combined with the individual's potential, makes possible the living of a richer, more useful life.

### Programs of Study

The College of Liberal Arts offers four degrees: Bachelor of Arts, Bachelor of Science, Bachelor of Fine Arts, and Bachelor of Music.

**Bachelor of Arts** programs primarily provide a broad liberal education along with a major in one of the fields listed on the previous page. Requirements for the Bachelor of Arts degree and information regarding these majors are presented on page 16.

**The Bachelor of Science** curriculum consists of an interdepartmental program in biology which permits students considerable specialization while providing them with a broad cultural education. Requirments for the Bachelor of Science degree and information regarding the biology curriculum are presented on page 36.

**The Bachelor of Fine Arts** curriculum provides training for students who plan to enter a professional graduate school. Requirements for the Bachelor of Fine Arts degree are outlined on pages 36-37.

**The Bachelor of Music** curriculum provides professional training in applied music, in musical theory, and in music education, and allows students to develop their talent to a standard equivalent to the one achieved at conservatories of music. Requirements for the Bachelor of Music degree and information regarding the curriculum are presented on pages 37-39.

**Note:** Although the University will try to provide sufficient facilities so that students may pursue any major or curriculum for which they meet the requirements, such a privilege cannot be guaranteed, since rapidly increasing enrollment sometimes results in the overcrowding of required specialized courses. On occasion, students may remain in a crowded curriculum if they are willing to take certain courses during the summer session.

### Five-Year Program: B.A.-M.B.A.

The College of Liberal Arts and the Whittemore School of Business and Economics offer a combined five-year program leading to a B.A. degree in French, history, philosophy, or psychology and an M.B.A. degree. Information about the program can be obtained from the department or from the undergraduate counselor in the Whittemore School.

### Combined Programs of Study

In addition to pursuing a single major, students may combine programs of study as follows.

**Minors:** See page 18 for requirements. See also Interdisciplinary Minors, page 55 and Women's Studies Minor, page 39.

**Second Majors:** See page 17 for requirements.

**Dual-Degree Programs:** See page 17 for requirements.

**Student-Designed Majors:** See page 92 for requirements.

Other combined programs and interdisciplinary opportunities are described in Special University Programs, page 91.

## Preparing for Teaching

### Five-Year, Undergraduate-Graduate Program

The major avenue for becoming certified to teach at the elementary, middle, or high school level is an integrated undergraduate-graduate program culminating in a fifth-year, year-long internship. Before the internship, students will earn a bachelor's degree outside the field of education. The internship offers 6-12 graduate credits and will normally be coupled with other graduate work leading to a master's degree. A number of existing UNH master's degree programs may be elected, including two offered by the Department of Education that are specifically designed for preservice teaching. (See Graduate Catalog for description.)

**Step 1.** Register for Educ 500 (preferably in sophomore year).

The initial undergraduate phase of the program, Educ 500, Exploring Teaching, provides an early experience in the schools as a teacher aide and teaching assistant. Students may select this four-credit course at any time; however, most should choose it before completing their sophomore year. In this initial phase, students, working side by side with experienced teachers, explore various kinds of teaching roles so that they may make realistic decisions about teaching as a career.

**Step 2.** Apply to the Department of Education for admission to the second phase of the teacher education program and for a co-adviser from that department, who will provide assistance in designing the most appropriate plan of studies. Such a plan requires a minimum of four credits to be completed in each of four areas of study: Educ 700, Educational Structure and Change; Educ 701, Human Learning and Development; Educ 703, Alternative Teaching Models; and Educ 705, Alternative Perspectives on the Nature of Education. Since there is no undergraduate major in education, students must select and complete a major in another department for a baccalaureate degree.

A number of variable-credit modules will be available to students in each of the required four course areas, including experiences and workshops in local schools. Certain courses in other departments may be substituted for these requirements. Working closely with advisers, students may develop highly individualized programs, choosing from many alternatives. Since credits in these four areas of study may be taken at either the undergraduate or graduate level, students will have greater flexibility for fulfilling the requirements of their college and major departments.

Additional requirements for elementary school teaching include one course in elementary school reading (Educ 706, Introduction to Reading Instruction in the Elementary Schools) and two courses in mathematics appropriate for elementary school teaching (recommended—Math 621, Number Systems for Elementary School Teachers; Math 622, Geometry for Elementary School Teachers; Math 623, Topics for Elementary School Teachers; 703, Mathematics Education, K-6).

**Step 3.** Apply for admission to the fifth-year internship and master's degree program.

The final phase of the teacher education program will consist of a year-long internship (Educ 800-801). **Students must apply for the fifth-year internship and master's degree program by September 15 of their senior year** so that they will have enough time to explore a variety of career and/or graduate study options and finalize their program plans before second semester of that year. Opportunities exist for admitted graduate students to take courses toward their master's degree in the second semester of their senior year.

Before the internship, students will complete a B.A. or B.S. program with a major outside the field of education. They will have, therefore, a broader general education and greater depth in their area of specialization, as well as opportunities for jobs outside of education.

If accepted into the internship and master's degree program, students will have many options from which to choose, including selection of additional courses for further specialization, and selection of workshops and courses offered for credit in intern-site schools. During the internship, students will have an opportunity to work with resident supervisors and other interns in various team-teaching arrangements.

**Financial Aid**

A limited number of paid internships are available. Students will be hired by participating school districts. Other financial assistance is possible through the Office of Financial Aid.

**Criteria for Admission to Fifth Year**

To be eligible for an internship, students must satisfy the following criteria: 1) favorable rating from school personnel who have worked with them in Exploring Teaching and in any other clinical experience; 2) favorable rating from UNH staff supervising Exploring Teaching and other clinical experience; 3) favorable recommendation from instructors of professional coursework; 4) favorable recommendation from their major program, including approval of the major program as appropriate for secondary school teaching; 5) admission to the UNH Graduate School, which requires a minimum of 2.50 cumulative grade-point average,

Graduate Record Examination scores, and appropriate letters of recommendation; 6) available space in the program.

### Undergraduate Certification Option

Because of the professional orientation of majors in occupational education, home economics, physical education, and music education, an undergraduate option for teacher certification in these areas may be elected. This option will require the same professional education components listed previously, with the election of one semester of student teaching (Educ 694) instead of the year-long internship. Successful completion of Educ 500 and positive recommendation from school-site staff are required for further professional work. Final screening will take place before the student-teaching semester. **Application for acceptance into student teaching must be filed by February 15 of the junior year.**

### Academic Standards for Eligibility to Apply for the Teacher Education Programs

#### Integrated Undergraduate-Graduate Option with Year-long Internship and Master's Degree

Academic record suitable for admission to graduate school.

#### Four-Year Undergraduate Option

Minimum of 2.50 grade-point average in major, minimum 2.20 cumulative grade-point average at time of application for student teaching (February 15 of junior year).

These programs have limited capacity, and admission to the University or satisfaction of minimum academic standards as stated previously does not guarantee admission to the teacher education programs.

### Accreditation and Certification for Teaching

The teacher education programs at the University are accredited by the New Hampshire State Department of Education and by the National Council for the Accreditation of Teacher Education. Completion of the approved teacher preparation program of the University qualifies students for certification as teachers in most states.

**UNH offers approved programs only in the following areas:** agriculture, art, biology, chemistry, early childhood education, earth sciences, elementary education, English, French, German, home economics, Latin, mathematics, music, occupational education, physical education, physics, social science, Spanish, speech therapy, and theater and communication. For secondary certification, students must have completed an approved major program or its equivalent in the teaching field.

For further information, contact Stephen R. Birrell, coordinator of teacher education.

## Bachelor of Arts Program

The Bachelor of Arts program provides a broad liberal education with a concentration involving a minimum of 32 credits in a major field.

### Bachelor of Arts Degree Requirements

See page 16 for requirements.

### Majors in the Bachelor of Arts Program in the College of Liberal Arts

A department may specify certain (but not more than 13) required courses. Students must declare a major before the beginning of the junior year.

The objectives, opportunities, and department requirements of the majors in the Bachelor of Arts program are described in the paragraphs that follow.

## Anthropology

The anthropology major, offered by the anthropology section of the Department of Sociology and Anthropology, provides an introduction to the various branches of anthropology and an appreciation of its place among other academic disciplines. At the same time, the major is designed to encourage intensive study of particular topics within the field, according to the interests and talents of students. It is intended to provide both a broad basis for the education of general students and to offer sufficient background for those who may wish to pursue a career in anthropology at the graduate level.

Majors must complete a minimum of 32 credits with grades of C- (1.67) or higher and a grade-point average of 2.00 or better, distributed as follows: Anth 411, 412, either 516 or 518, one topical course, one ethnographic-area course, and

any other four courses in anthropology (including Soc 770) or related disciplines approved by the supervisor.

Students wishing to major in anthropology should consult with Associate Professor Richard E. Downs.

### Departmental Honors

Honors in anthropology will be awarded to those students who achieve, in addition to the regular requirements of the major, at least a 3.67 grade-point average in courses counted toward the major and satisfactorily complete a four-credit senior thesis under the guidance of a faculty member. A 3.50 overall average is also required. Students wishing to work for honors should inform the undergraduate committee of their intent during the second semester of their junior year, appending their academic record and a statement of the area in which they intend to write a thesis.

## The Arts

The courses offered by the Department of the Arts provide an opportunity, within the liberal arts framework, for serious art students to acquire a thorough knowledge of the basic means of visual expression, to acquaint themselves with the history of art, or to prepare themselves for a career in art teaching. In addition, these courses are designed to offer foundation experience for students who are interested in art but are majoring in other departments in the University. The Department of the Arts offers programs leading to a Bachelor of Fine Arts degree (see page 36) and a Bachelor of Arts degree. Certification for art teaching in the public schools is also offered in cooperation with the Department of Education (see Preparing for Teaching, page 23).

The arts major leading to a Bachelor of Arts degree is offered with two options: studio and art history.

Candidates applying for the arts major, art studio option, or the Bachelor of Fine Arts program are required to submit a portfolio. There is no portfolio requirement for those entering the art history option of the arts major. The University reserves the right to retain selections from a student's work for a period of not more than two years.

### Art Studio Option

Students selecting the art studio option must complete a minimum of 11 courses (44 credits), of which the following are required: Arts 432 (Drawing I); one course from the following: Arts 501 (Ceramics I), Arts 513 (Jewelry and Metalsmithing I), Arts 525 (Woodworking), or Arts 567 (Sculpture I); two 400-level art history courses; two 500-level art history courses; one elected art history course; three elected studio courses; and one 600-level studio course. The foundation courses (400-level courses) should be completed during the first year.

While these courses represent the minimum departmental requirements for the studio option, students may wish to plan a program involving greater depth in one or several of the studio areas.

### Art History Option

Students selecting the art history option must complete a minimum of 10 course (40 credits) of which the following are required: Arts 432, Drawing I; Arts 431, Visual Studies; two additional 400-level art history courses; Arts 696, Methods of Art History; and five additional courses in art history above the 400-level, of which at least two must be in the Ancient and Medieval areas and at least two must be in the Renaissance and Modern areas. Art history majors will receive preferential placement only in the following studio course: Arts 432. Students majoring in art history are strongly advised to take Engl 501, Introduction to Prose Writing, and two foreign languages, one of which should be German.

### Art Education Curriculum

The program in art education is organized into a five-year, teacher-education sequence.

This curriculum is designed to prepare teachers of art in the public schools. Completion of the B.A. or B.F.A. degree before a fifth-year internship is necessary for teacher certification. The satisfactory completion of the B.A. or B.F.A. curriculum and the fifth-year internship will satisfy the initial certification requirements for teachers of art in the public schools of New Hampshire and in most other states.

## Classics

The classics major is offered by the classics section of the Department of Ancient and Modern Languages and Literatures. The minimum requirements for a major in clas-

sics are: 40 credits offered by the classics section, excluding Latin 401-402. Twenty-four of these must be in courses in Greek and Latin. Students will be encouraged to take courses in related fields such as ancient history, classical art, modern languages, and English.

The supervisor for majors is Associate Professor John C. Rouman.

### Departmental Honors

The Honors Program in Classics is designed primarily and specifically for students of superior ability, demonstrated achievement, and high interest in the study of both Greek and Latin. Students may apply for admission to the program during their junior year. Applicants must have completed at least: Latin 504 and Greek 504, either Latin 601 or Greek 601, one 700-level literature course in Latin, and one 700-level literature course in Greek. Applicants must have a minimum grade-point average of 3.67 in their Latin, Greek, and classics courses, as well as a 3.50 overall average. Students meeting these criteria may apply to the program by writing to the coordinator for classics and seeking the approval of the classics faculty. Each student admitted to the honors program receives a faculty adviser who is responsible for arranging the student's subsequent program. The faculty adviser will be appointed to teach "Introduction to Classical Scholarship," either Latin 795I or Greek 795P, depending on the student's classical language of primary interest. The honors student must complete satisfactorily an honors thesis and a final oral examination covering aspects of Greco-Roman studies and classical scholarship. In addition to the course in Classical Scholarship, the honors student's total program shall include no less than either four 700-level courses in Greek and two 700-level courses in Latin, or four 700-level courses in Latin and two 700-level courses in Greek, depending on which classical language is the object of the student's primary interest and the focus of the student's research course in Classical Scholarship.

## Communication

Communication is one of two majors offered in the Department of Theater and Communication. The major emphasizes a broad, integrative approach to theories and practices of verbal, nonverbal, mass, and other forms of communication. Interdepartmental coursework, reasonable course substitution on an individual basis, proficiency exemption, and field or laboratory work are encouraged to meet individual communication needs or goals. Communication coursework can be readily related to social sciences, humanities, etc., and provides a preprofessional preparation for vocations such as law, public relations, personnel work, mass communication, and cinema.

Majors in communication shall select ten courses (40 hours) distributed as follows: all students are required to take ThCo 402 and 403; a minimum of two courses (eight hours) from each of the three areas of rhetoric and public address, communication studies, and mass communication; and two courses (eight hours) in an area of emphasis determined in consultation with their advisers. The courses applicable to each category are available from the department.

Students interested in majoring in communication should consult with the chairperson of the Department of Theater and Communication. Students wishing to transfer to the University of New Hampshire and major in communication must first have the approval of the department.

## English

The Department of English offers two programs of study: the English major and the English teaching major.

### The English Major

The English major has two chief objectives: to provide all students with a common core of literary experience and to provide each student with the opportunity of shaping a course of study to suit individual interests. The flexibility and freedom inherent in the second of these objectives places a responsibility upon students to devise a program that has an intelligent rationale. For example, students who intend to pursue graduate study in English literature should choose more than the minimum number of advanced literature courses and should seek a broad, historical background. Students with special interests in linguistics or writing may, on the other hand, wish to elect only the minimum number of advanced literature courses required for the major. All students should secure the assistance and approval of their advisers in formulating an early plan for the major program.

The English department offers a journalism program which, though not a major, prepares students to become professional journalists upon graduation. The program consists of five sequential writing courses which students should begin no later than the second semester of the sophomore year. Internships at daily newspapers are available. Students interested in this program should inquire at the departmental office.

For the English major, students must complete a minimum of 32 credits of major coursework including: Engl 519, two additional 500-level courses, and seven courses numbered 600 and above. In selecting these courses, students must be sure to meet the following distribution requirements:

**1.** Two courses in literature prior to 1800: either two advanced courses (numbered 600 or above), or one advanced course and Engl 513.

**2.** Two courses in literature since 1800: either two advanced courses, or one advanced course and one course from the following list: Engl 514, Engl 515, Engl 516.

Students interested in majoring in English should consult the chairperson, Professor Jean Kennard.

### The English Teaching Major

This major is designed for students wishing to teach English in middle or high schools. Completion of this undergraduate major does not in itself, however, meet state certification requirements. To meet these requirements, students should enroll in the undergraduate major and, by September 15 of their senior year, apply for the fifth-year teaching internship and master's degree program. (For a full description of requirements for the integrated undergraduate-graduate program for teachers, and its several options, see the section entitled "Preparing for Teaching," page 23.) Undergraduate English teaching majors must pass the following English courses with an average of 2.50 or better: Engl 512, 514, 519, 619, 657, 712, 718 or 719, 791-792, and two additional literature courses numbered above 700. Engl 513 may be substituted for the second 700-level course.

Students who are interested in majoring in English teaching should contact Associate Professor Lewis Goffe.

## French

The French major is offered through the French section of the Department of Ancient and Modern Languages and Literatures. In addition to its value in the context of the liberal arts, the major provides knowledge of the language, literature, and culture of France which is useful in a number of careers, such as teaching, business, law, and social service. Prospective teachers should consult the section on "Preparing for Teaching," page 23. Students interested in nonteaching careers are urged to consult with the French section and with other appropriate departments early in their academic careers. Special attention is called to the minor in administration offered through the Whittemore School.

A *major* consists of a minimum of 36 credits. Fren 401-402, 501, 503-504, 514, 516, 621, and 622 do not count toward a major. Fren 605-606 and 790 are required of majors. Majors are encouraged to take courses in the literatures of other countries as well as in fields such as music, art, philosophy, history, political science, and sociology which provide insight into nonliterary aspects of culture. A *minor* in French consists of 20 credits in French courses numbered 501 and above. The coordinator of French supervises the work of both majors and minors.

The French section also offers a junior year abroad at the University of Dijon. This program is open to all qualified students at the University of New Hampshire. See Description of Courses, Fren 685-686. Early consultation with the section is urged.

### Five-Year, Dual-Degree Program in French and Business Administration

The dual-degree program permits students to earn both a B.A. in French and an M.B.A. in business administration in five years instead of the normal six. All requirements for both the French major and the M.B.A. program offered by the Whittemore School of Business and Economics will be met. A maximum of 16 credits may be counted toward both degrees. Students interested in this program should consult with the departmental adviser to the program early in their sophomore year.

## Geography

Geography is best defined as the discipline that describes and analyzes the variable character, from place to place, of the earth as the home of man. As such, geography is an integrating discipline, studying many aspects of the physical and cultural environment that are significant to understanding the character of areas or the spatial organization of the world.

Because its integrating character establishes common areas of interest with many other fields of knowledge, geography is an excellent core discipline for a liberal education. Thus, students who have a primary interest in the spatial organization or the regional character of the world and who also desire a liberal education can attain these goals by majoring in geography. Those wishing to prepare for careers as professional geographers are advised to concentrate their coursework in geography and closely related fields, and they should plan to go on to graduate study after completing an undergraduate major in geography.

Students who major in geography are required to take Geog 401, 402, and seven additional courses in geography or related fields approved by their supervisor to a total of 28 semester credits. The seven courses should include Geog 570, 572; 581, 582; 797; and two additional intermediate-level courses in geography.

A minor consists of five courses (20 credits) in geography.

Students interested in majoring in geography should consult with the supervisor, Professor William H. Wallace.

## German

The German major is offered by the German section of the Department of Ancient and Modern Languages and Literatures. This program is designed to be of interest to the following groups of students:

**1.** Those who have a special interest in the German language, literature, and culture.

**2.** Those who intend to enter fields in which a background in foreign languages and literatures is desirable. Examples are: international banking, trade, science, government service, and library science.

**3.** Those who plan to teach German in secondary schools. Since most secondary schools require their teachers to teach more than one subject, students planning to enter teaching at this level must plan their programs carefully. They should combine a major in one of the languages and its literature with a minor or at least a meaningful sequence of courses in another subject.

**4.** Those who intend to pursue graduate study in Germanic linguistics and literature. Such graduate study is an essential prerequisite for teaching and research at the university level.

The German section offers a junior year abroad at the University of Salzburg. This program is open to all qualified students at the University of New Hampshire. See Description of Courses, Germ 685-686.

A major must include a minimum of 36 credits in German language, literature, and culture beyond Germ 504. Germ 525, 526, 601, 602 (or their equivalents), 781, and eight other credits on the 600 or 700 level, excluding Germ 791, are required for all majors. Achievement examinations will be given at the end of the junior and senior years.

## Greek

The Greek major is offered by the classics section of the Department of Ancient and Modern Languages and Literatures. The supervisor for majors is the coordinator for classics, Associate Professor John C. Rouman.

The minimum requirements for a major in Greek are: 32 credits in Greek, including Grek 401-402. Students will be encouraged to take courses in related fields such as Latin, classics, and ancient history.

For the Honors Program in Classics, see page 27.

## History

Students majoring in history must complete 32 credits in history courses numbered 500 or above with a grade of C- or better and an overall average in these courses of 2.00 or better. These courses must include a minimum of one semester-course each from Groups I, II and III listed in the Description of Courses. At least four semester-courses of the total must be numbered 700 or above. This must include Hist 797, Colloquium in History, which all senior history majors are required to complete. History majors must complete Hist 500, Introduction to Historical Thinking, in the

semester following declaration of major. For transfer students, a minimum of four of the semester-courses used to fulfill the major requirements must be taken at the University of New Hampshire and at least two of these must be numbered 700 or above.

Students intending further work in history beyond the bachelor's degree are urged to take Hist 775, Historical Methods.

Students intending to major in history should consult with the chairperson of the department's undergraduate committee. Suggested programs for students with special interests or professional plans are available in the department office.

### Five-Year, Dual-Degree Program in History and Business Administration

The dual-degree program permits students to earn both a B.A. in history and an M.B.A. in business administration in five years instead of the normal six. All requirements for both the history major and the M.B.A. program offered by the Whittemore School of Business and Economics will be met. A maximum of 16 credits may be counted toward both degrees. Students interested in this program should consult with the history department adviser early in their sophomore year.

## Humanities

The major in humanities allows students to design and pursue under faculty guidance a coherent interdisciplinary program in the humanities (art, drama, language, literature, music, philosophy). The student defines the subject and selects a program of related courses. The subject may be a historical period or any other topic that may be explored through several disciplines in the humanities. The program must have clear educational and intellectual merit and prepare the student to undertake a senior project of at least four credits on the subject (Huma 699). The program must be sponsored by a faculty member from the Humanities Division and approved by the Executive Committee of the division.

Students who wish to become humanities majors should submit a formal proposal to the committee by the end of the sophomore year. Normally, students should have a grade-point average of at least 2.70. Students should select most of the courses for the program from those offered for major credit by departments within the Humanities Divison, but are also encouraged to include courses from outside the division (especially from history) when they are appropriate to the major subject. The number of courses in the program may vary, but at least 32 credits of major coursework must be completed.

Before submitting formal proposals, interested students are urged to seek the advice of committee members and other faculty in the Humanities Division. Inquiries about the humanities major should be directed to Professor Charles Leighton, supervisor of the Humanities Major Program, Department of Ancient and Modern Languages and Literatures.

## Latin

The Latin major is offered by the classics section of the Department of Ancient and Modern Languages and Literatures. The supervisor for majors is the coordinator for classics, Associate Professor John C. Rouman.

The minimum requirements for a major in Latin are: 32 credits in Latin, excluding Latn 401-402. Students will be encouraged to take courses in related fields such as Greek, classics, and ancient history.

For the Honors Program in Classics see page 27.

## Linguistics

Linguistics is the study of one of the most important characteristics of human beings: language; it cuts across the boundaries between the sciences and the humanities. The program is an excellent liberal arts major or preprofessional major for law, medicine, clergy, and others. Dual majors with a foreign language, business administration, and the like, are quite feasible.

The program is based on 32 credits of linguistics courses, four core courses and four additional area courses. The language requirement is: two years of college study (or equivalent) of one foreign language and one year of a second language from a different language family or subfamily.

A minor in linguistics consists of four core courses, and two additional courses from the area courses.

Students interested in the major or the minor should consult with the program director, program secretary, or with any professor who teaches linguistics courses. To declare a major in linguistics, students must first submit a proposal, signed by a faculty sponsor, to the Linguistics Committee. Information is available from the Advising Center, Murkland Hall.

### Core Courses

Students must take a total of four core courses. (titles are given below under the departments.)

*Introductory courses:* Linguistics 505 and Linguistics 506; both are required.

*Syntax and Semantics:* ThCo 572; Psyc 712; Phil 745; Engl 794; one is required.

*Phonetics and Phonology:* Comm 524; Engl 793; one is required.

### Area Courses

*Anthropology:* 795-796, Anthropological Linguistics.

*Classics:* 595-596 H, Sanskrit; 595, 596, Independent Study; Hittite (by arrangement).

*Communication Disorders:* 524, Applied Phonetics of American English; 638, The Acquisition of Language.

*English:* 715, Applied Linguistics; 716, Problems in Applied Linguistics; 719, English Grammar; 752, History of the English Language; 753, Old English; 754, Beowulf; 793, Phonetics and Phonology; 794, Syntax and Semantic Theory.

*French:* 791, Methods of Foreign Language Teaching.

*German:* 781, History and Development of the German Language; 791, Methods of Foreign Language Teaching; 795, Special Studies.

*Latin:* 791, Methods of Foreign Language Teaching; 795, 796, Independent Study.

*Linguistics:* 795, 796, Independent Study.

*Philosophy:* 412, Beginning Logic; 550, Symbolic Logic; 712, Advanced Logic; 745, Philosophy of Language.

*Psychology:* 511, Introduction to Perception, Language, and Thought; 712, Psychology of Language; 812, Psycholinguistics.

*Spanish:* 601, Spanish Phonetics; 791, Methods of Foreign Language Teaching; 795, History of the Spanish Language.

*Theater and Communication:* 572, Language and Behavior; 630, Psychology of Communication; 673, Experimental and Descriptive Studies in Oral Communication; 783, Theories of Language.

Other courses may be substituted, with the permission of students' advisers and the Linguistics Committee, when they are pertinent to the needs of the students' programs.

## Microbiology

Microbiology explores the fundamental nature of living organisms which cannot be seen by the unaided eye. The primary emphasis is on bacteria and viruses. Such learning is especially valuable to students planning to enter city, state, or federal government service, or positions with universities, research institutes, or industrial organizations. Some students go on for graduate work. The principal areas of concentration in the department are: 1) general; 2) medical; 3) public health; 4) environmental; 5) marine and soil microbiology; 6) microbial cytology and ultrastructure; and 7) virology.

A minimum of 28 semester credits from department offerings must be completed in addition to a course in biochemistry (Bchm 601 or 656). Chem 403-404 should be taken in the freshman year, and Organic Chemistry (Chem 545 or 651-652) is also required. Within the Department of Microbiology, the following core courses are required: General Microbiology (503), and Taxonomy and Ecology (701). For students desiring a strong background in medical microbiology, Pathogenic Microbiology (702), Immunology and Serology (705), and Virology (706) are recommended. For students wishing to emphasize natural processes, the following courses are recommended: Marine Microbiology (707), Microbial Biogeochemistry (708), and Soil Microbiology (712). Environmental Microbiology (600), Microbial Genetics (704), and Microbial Cytology (709-710) are recommended as courses valuable to microbiology majors. The Problems in Microbiology course (795-796) is available for students by special permission. For students considering graduate school and the microbiology registry exam, courses in mathematics through calculus, physics, quantitative analysis, and introductory courses in botany and zoology are strongly recommended. The courses for each

major program are selected to meet the needs of the individual, as determined by the student and the adviser.

Students interested in majoring in microbiology are advised to consult Professor Galen E. Jones.

## Music

The Department of Music offers two degree programs: the Bachelor of Arts and the Bachelor of Music. The Bachelor of Music degree is discussed on page 37.

The Bachelor of Arts program offers students an opportunity to major in music within the liberal arts curriculum. This program is intended for those who wish to pursue the serious study of music and to acquire at the same time a broad general education; it is recommended for those considering graduate study leading to the M.A. or Ph.D. degrees, or the five-year undergraduate-graduate program in teacher education.

To be admitted formally to the B.A. program, students must give evidence of satisfactory musical training by taking an admission audition. Students must declare music as a major before the beginning of the junior year, but it is highly recommended that they declare as early as possible, considering the large number of required courses. Admission to the upper level of the degree program will be subject to review by the Department of Music faculty.

The Bachelor of Arts degree is offered with four options: music history, performance study, music theory, and preteaching. All students must complete a minimum of 32 credits of coursework in music, of which the following are required: Musi 471-472, 473-474, 571-572, 573-574, and 501-502. In addition, the requirements for each option are given below:

### Option I

**Music history:** advanced theory (4 credits); advanced history and literature (12 credits); any one of 541-550 inclusive (8 credits). Students must also demonstrate the ability to sight-read a Bach chorale harmonization.

### Option II

**Performance study:** Advanced theory or literature (4 credits); performance study (16 credits—two credits per semester). Qualified students may major in voice, piano, strings, woodwinds, brass, or percussion. Voice majors must successfully complete, in addition to the foreign language requirement, one of the following course sequences: Ital 401-402, Germ 401-402, Fren 401-402.

### Option III

**Music theory:** advanced theory (12 credits); advanced history (4 credits); any one of 541-550 inclusive (8 credits). Students must also demonstrate the ability to sight-read a Bach chorale harmonization. The emphasis in this option is on musical composition and/or theory.

### Option IV

**Preteaching:** MuEd 500; Musi 751-752; Musi 779; techniques and methods (8 credits); 8 credits from Musi 441-453 inclusive; 8 credits from any one of Musi 541-550; piano proficiency. (See page 23, Preparing for Teaching.)

A public performance is given during the senior year—for music history majors this must be a lecture or lecture-recital; for performance majors, a full recital; for theory majors, a lecture, lecture-recital, or a recital including at least one original composition; for preteaching majors, a half-recital is the minimum. A more detailed description is available from the Department of Music.

All students minoring in music must complete a minimum of 20 credits of coursework in music, of which the following are required: Musi 471-472, Musi 473-474, Musi 501-502.

The Department of Music is a member of the National Association of Schools of Music. Prospective B.A. majors in music are advised to consult with Associate Professor Paul Verrette.

## Philosophy

Philosophy has always been the heart of a liberal education, deepening and enriching the lives of those who pursue it. It is also excellent preparation for a variety of vocational and professional endeavors.

### The Philosophy Major

The following courses constitute a core required of all majors: 570, 575, 640; 530; and one from 610, 615, 620. Students conscious of a more-than-ordinary interest in philosophy should take these core courses as early as possible.

Beyond the core, majors must select, with their advisers' approval, three additional philosophy courses (exclusive of 699 and 795-796) at or above the 500 level, at least two of which must be at the 700 level, for a minimum of eight courses.

### Special-Interest Program

Students may add to the above major a special-interest program of value in planning for postgraduate education or entry into such areas as law, medicine, business, education, theology, or social work. Special advisers are prepared to provide informal counsel to philosophy majors interested in these areas.

### Graduate Preparatory Emphasis

This emphasis is strongly recommended for students who plan to do graduate work in philosophy. Beyond the five core courses, such students should select, with their advisers' approval, six additional philosophy courses above the 400 level, for a total of eleven courses. At least three of these six should be on the 600-700 level (exclusive of 699 and 795-796) and one of them should be 550.

### Five-Year, Dual-Degree Program in Philosophy and Business Administration

The dual-degree program permits students to earn both a B.A. in philosophy and an M.B.A. in business administration in five years instead of the normal six. All requirements for both the philosophy major and the M.B.A. program offered by the Whittemore School of Business and Economics will be met. A maximum of 16 credits may be counted toward both degrees. Students interested in this program should consult the departmental adviser to the program early in their sophomore year.

### Departmental Commendation

Students accepted for departmental commendation will register for 699 (usually during the second semester of the senior year) and will write, under the guidance of an adviser, an original paper in philosophy. If completed successfully, students will receive a letter of commendation. Students interested in the honors program in philosophy must first meet the eligibility standards set by the College of Liberal Arts and should then contact the department chairperson for information.

### Philosophy Minor

Any five philosophy courses constitute a minor.

## Political Science

The study of politics, to which the courses and seminars of the Department of Political Science are devoted, includes the development of knowledge of political behavior by individuals and groups as well as knowledge about governments: their nature and functions, their problems and behavior, and their interactions—at the national and international levels and at the local, state, and regional levels.

Much of the learning offered by the Department of Political Science can also be regarded as essential for good citizenship, since political knowledge helps to explain both the formal institutions by which societies are governed and the issues that encourage people toward political interest and political action. In addition, such learning is especially valuable to students planning to enter local or national government or other public service, including the foreign service, and will be of great help to those who intend to study law and enter the legal profession. For teaching, particularly at the college level, and for many types of government service, graduate work may be indispensable, and an undergraduage major in political science will provide the most helpful foundation for further study in the field. Such an emphasis will also be valuable for students seeking careers in journalism, international organizations, and the public affairs and administrative aspects of labor, financial, and business organizations.

The major program in political science consists of at least nine courses (36 credits) and not more than 12 courses (48 credits), to be distributed in the following way:

**1.** Two from the offerings at the 400 level. These courses are designed for the introductory level and should be completed by majors by the end of the sophomore year.

**2.** Six from the offerings at the 500 and 600 levels. Of these, at least one shall be chosen from each of the four fields in which the department's courses are organized: American politics, comparative politics, international politics, and political thought.

3. One from the offerings at the 700 level.

In addition to the courses regularly offered, the department will have available selected topics, independent study, and internships. Interested students should check with the department office to learn of the offerings for a given semester.

## Psychology

A general function of the Department of Psychology is to provide an academic major that will contribute to the broad education of undergraduates. Specifically, students will be exposed to the scientific study of behavior and will achieve an increased understanding of the behavior of humans and animals.

Students majoring in psychology are required to complete 32 credits distributed as follows: 1) Psyc 401; 2) Psyc 601; 3) two courses, selected from among the following options: Psyc 602, 621, 702 through 732; 4) two courses from among the following options: Psyc 651, 652, 754 through 781; 5) two additional courses from among the 600-level and 700-level departmental offerings. Specific course selections should be discussed with advisers. It is recommended that students take Psyc 401 and 601 before officially declaring psychology as a major. Exceptions to the prescribed major requirements must be petitioned through the department.

Psychology majors planning to go on to graduate work in psychology should include Psyc 602 or 704 among their courses.

The minor in psychology consists of five courses (20 credits), including Psyc 401 and at least 3 courses at the 500 level or above. No more than 4 credits of independent study may be applied toward the minor requirements.

See the department's undergraduate secretary for further details on both the major and the minor in psychology.

### Five-Year, Dual-Degree Program in Psychology and Business Administration

The dual-degree program permits students to earn both a B.A. in psychology and an M.B.A. in business administration in five years instead of the normal six. All requirements for both the psychology major and the M.B.A. program offered by the Whittemore School of Business and Economics will be met. A maximum of 16 credits may be counted toward both degrees. Students interested in this program should consult with the departmental adviser to the program early in their sophomore year.

## Social Service

The social work major prepares graduates for social work practice within the context of a liberal arts education. It also prepares students for admission to graduate schools of social work and other graduate professional programs in human service professions.

Social work majors pursue a program that deals with the origin, development, and organization of health and welfare institutions; methods of social work practice; and the relationship of the social work professions to contemporary social issues and problems. Social work majors gain direct experience and a better understanding of the field in required participation in a social welfare setting for a minimum of 300 hours. The details of the field experience will be arranged between the student and the designated faculty.

Social work majors are required to take SS 522, 523, 622, 623, and 631; Soc 601; and one course from each of four designated areas, a listing of which will be provided by the faculty advisers. Students wishing to major in social work should consult with the chairperson, Professor Pauline Soukaris, in Murkland Hall.

## Sociology

The major in sociology is designed to provide a degree of concentration in the study of society consonant with a broad liberal education. However, those who wish to teach sociology in secondary schools are advised to consult with the chairperson of the Department of Education for additional courses in related subjects and teaching that may be required. Those who wish to pursue a career in social service should consult with the chairperson of that department about additional courses or possibilities for graduate training. Those who wish to enter graduate programs in sociology should consult with their advisers about addi-

tional courses, particularly in the areas of theory, statistics, and methodology, that they should take.

Majors must complete a minimum of 36 semester credits with grades of C- (1.67) or higher and a grade-point average of 2.00 or better in sociology courses (including Anth 625.) Soc 400 (or 500 or 600), 601, 602, 611, and 612 are required. At least two of the additional major courses must be at the 600 or 700 level (not including 795 or 796).

Students interested in majoring in sociology should consult with the chairperson of the Departmental Committee for Undergraduate Studies. It is the responsibility of all sociology majors to obtain the latest information from the department office.

### Departmental Honors

Honors in sociology will be awarded to students who achieve, in addition to the regular requirements of the major, at least a 3.67 grade-point average in courses counted toward the major and satisfactorily complete a four-credit senior thesis under the guidance of a faculty member. A 3.50 overall grade-point average is also required. Students wishing to work for honors should inform the undergraduate committee of their intention during the second semester of their junior year, appending their academic record and a statement of the area in which they intend to write their thesis.

## Spanish

The major in Spanish, offered through the Spanish section of the Department of Ancient and Modern Languages and Literatures, is for those students who wish to acquaint themselves more thoroughly with the language, culture, and literature of the Spanish-speaking peoples.

In addition, through the major, students can prepare for practical goals: teaching Spanish in grade or high schools, or teaching other subjects in bilingual programs. With advanced degrees, teaching at the college level and engaging in scholarly research or entering such fields as linguistics or library science are career opportunities. Majors gifted in languages may consider the fields of translation and interpretation. With coursework in business, sociology, psychology, speech, etc., Spanish majors may prepare for work in Spanish-speaking areas of the world as well as in bilingual regions of the United States and also with many governmental agencies.

The Spanish section sponsors a Junior Year Abroad program which is open to majors and nonmajors. Contact the Spanish section for further details.

The major consists of a minimum of 34 credits in courses numbered 504 and above. Specific course requirements are 1) language and culture: 525 or 526, 601, 631-632; 2) introductory literature: students must take a total of three courses; either the sequence 651-652 or the sequence 653-654 plus one semester from the sequence not chosen; 3) advanced literature: two courses at the 700 level.

Interested students should talk to the coordinator or undergraduate adviser for Spanish.

## Theater

Theater as a composite art, reflecting life, is closely related to painting, sculpture, music, dance, literature, and philosophy. One of the two majors offered in the Department of Theater and Communication, the theater major stresses a broad background in the arts within their social framework. Students interested in the creative aspects of speech communication will find an opportunity for personal and preprofessional growth in theater and its drama, with opportunity for independent study of basic theories and personal involvement in active laboratory situations.

The required curriculum for theater majors consists of: ThCo 402, 435, and a minimum of eight hours from each of the three areas (theory/history, design/technical, performance) plus one full course or its equivalent from Performance Project and/or Scenic Arts Project. In addition, Senior Seminar and Senior Project (697; 698) are required, plus an additional eight hours (distributed or in one area) at the 600-700 level. The courses applicable to each category are available from the students' advisers.

There are three other course sequences available within the theater major: 1) courses leading to a major that when combined with requirements from the Department of Education qualify students for secondary school certification; 2) courses leading to a major that when combined with the requirements of the Department of Education prepare students for elementary certification with an undergraduate

specialization in youth drama; 3) courses leading to a theater major with a concentration in dance. (In order to be eligible to take either of the first two sequences, students must qualify for the five-year certification program in the Department of Education.)

All students interested in majoring in theater should consult with the chairperson of the Department of Theater and Communication. Students wishing to transfer to the University of New Hampshire and major in theater must first have the approval of the department.

## Zoology

The zoology major is designed to prepare students for admission to graduate work, at least two years of which is considered minimal for undertaking professional work in pure or applied zoology. Other students may elect the major, however.

The University's location on tidewater and near the open ocean provides an unusual opportunity for study of marine zoology and marine ecology.

Zoology majors must complete 32 credits of biology (botany, biology, entomology except 400, microbiology except 501 and 502, and zoology) courses with a 2.00 average and at least a C- (1.67) in each course. Minimum requirements for the zoology major are as follows: Chem 403-404; organic chemistry; calculus (Math 425) or statistics; college physics: Zool 412; Bot 411 or 412; Biol 541; at this point, students may select the vertebrate track and choose Zool 518, 527, 604, and 629, plus an elective, or they may select the invertebrate track and complete Zool 528, 537, 604, and 628, plus an elective. A suggested sequence of courses follows:

*Freshman:* Zool 412, Bot 411 or 412, Chem 403-404, and Math 425 (or INER 528).

*Sophomore:* Zool 518 and 527 or Zool 528 and 537, Biol 541, Chem 545.

*Junior:* Zool 604, Phys 403 (and INER 701 if taken in addition to or instead of Math 425).

*Senior:* Zool 629 or 628, another biological sciences course in zoology or other biological sciences department (may be taken earlier than the senior year).

Students who are interested in a zoology major should consult the supervisor, Assistant Professor Edward N. Francq.

## Bachelor of Science Curriculum in Biology

The Bachelor of Science curriculum in biology is an interdepartmental program that permits students considerable specialization while providing them with a broad cultural education.

### Degree Requirements

**1.** At least 128 credits with a minimum cumulative grade-point average of 2.00 in all courses completed at the University of New Hampshire.

**2.** Completion of the University General Education Requirements, including Engl 401.

### Major Requirements

Specific curriculum requirements are presented in detail on page 92.

## Bachelor of Fine Arts Curriculum

The Bachelor of Fine Arts curriculum provides training for students who plan to enter professional graduate school or pursue careers as professional artists. The basic unit of nine courses consists of drawing (Arts 432, 532), beginning oil painting (Arts 542), sculpture (Arts 567), sophomore seminar (Arts 598), and four courses in art history. This unit is designed to provide a common body of concepts and techniques and is intended to raise the level of creative achievement for all students in the B.F.A. degree curriculum.

During the junior and senior years, students will concentrate on six courses, two of which must be at the 600 level, in one of the major program areas of the department. The major programs are: 1) painting; 2) sculpture; 3) individualized programs. Individualized programs may be designed in the following subject areas: A) ceramics; B) drawing; C) weaving; D) graphics; E) metalsmithing; F) photography; and G) wood furniture design. Proposals for individualized programs are accepted only by permission of the department chairperson, the major adviser, and the Departmental Bachelor of Fine Arts Faculty Committee.

Advanced students will also be required to take four art electives. Finally, each senior will be required to take Arts 798, Seminar/Senior Thesis, which culminates in the mounting of an exhibition of the student's work. (Printed copies of suggested sequences of courses may be obtained from the Department of the Arts. Also, see the following listing.)

The four courses in art history required in this program are used to satisfy partially the University's Group III General Education Requirement.

Candidates applying for the Bachelor of Fine Arts program are required to submit a portfolio.

**Suggested Sequences of Courses**
**B.F.A.—Painting**

| **Freshman Year** | **Fall** | **Spring** |
|---|---|---|
| Arts 432, Drawing I | 4 | |
| Arts 483, Art of the Modern World | 4 | |
| Non-Art Academic | 8 | 8 |
| Arts 532, Drawing II | | 4 |
| Arts 542, Oil Painting I, or Arts 544, Water Media I | | 4 |
| **Sophomore Year** | | |
| Arts 567, Sculpture I | 4 | |
| Arts 533, Drawing III | 4 | |
| Art History Elective | 4 | |
| Non-Art Academic | 4 | 4 |
| Arts 547, Oil Painting II | | 4 |
| Arts 598, Sophomore Seminar | | 4 |
| Art History Elective (500 or above) | | 4 |
| **Junior Year** | | |
| Arts 548, Oil Painting III, or Arts 645, Water Media II | 4 | |
| Art Elective | 4 | |
| Non-Art Academic | 8 | 4 |
| Arts 643, Oil Painting IV | | 4 |
| Arts 796, Independent Study—Painting | | 8 |
| **Senior Year** | | |
| Arts 798 Senior Seminar/Thesis | 8 | |
| Arts 644, Oil Painting V | 4 | |
| Non-Art Academic | 4 | 8 |
| Art Elective | | 4 |
| Art History Elective (500 or above) | | 4 |

**B.F.A.—Sculpture**

| **Freshman Year** | | |
|---|---|---|
| Arts 432, Drawing I | 4 | |
| Arts 483, Art of the Modern World | 4 | |
| Non-Art Academic | 8 | 8 |
| Arts 532, Drawing II | | 4 |
| Arts 567, Sculpture I | | 4 |
| **Sophomore Year** | | |
| Arts 668, Sculpture II | 4 | |
| Art History Elective | 4 | |
| Arts 542, Oil Painting I, or Arts 544, Water Media I | 4 | |
| Non-Art Academic | 4 | 8 |
| Arts 669, Sculpture III | | 4 |
| Arts 598, Sophomore Seminar | | 4 |
| **Junior Year** | | |
| Arts 768, Sculpture IV | 4 | |
| Art History Elective | 4 | |
| Non-Art Academic | 4 | 4 |
| Arts 796, Independent Study—Sculpture | | 8 |
| Arts 767, Casting | | 4 |
| **Senior Year** | | |
| Arts 798, Senior Seminar/Thesis | 8 | |
| Art Elective | 4 | 4 |
| Non-Art Academic | 4 | 8 |
| Art History Elective (500 or above) | | 4 |

## Bachelor of Music Curriculum

The Bachelor of Music degree program is offered to students who wish to develop their talent in performance, composition, or music education to a high professional level. The program is recommended to those considering graduate study leading to the Master of Music or Doctor of Musical Arts degrees. Prospective majors are advised to consult with Associate Professor Paul Verrette.

To be admitted to the B.M. program, students must demonstrate a high degree of musical competence or significant creative ability during an audition or examination. Selectivity is exercised as appropriate to the professional requirements of each programmatic option. Students must formally declare the B.M. as a degree program before the beginning of the sophomore year. Continuation into the

upper level of the program is subject to review by the faculty of the Department of Music.

A public performance is required during the senior year. (For performance majors this must be a full recital; for theory majors, a lecture, lecture-recital, or a recital including at least one original composition; for music education majors, a half recital is a minimum.) A more detailed description is available from the Department of Music.

The Bachelor of Music curriculum offers concentration in the following areas: option 1, pinao; option 2, organ; option 3, voice; option 4, strings, woodwinds, brass, or percussion; option 5, theory (composition); option 6, music education.

Requirements for the degree include: 128 semester credits; a minimum 2.00 grade-point average in all courses completed at the University of New Hampshire; selected General Education Requirements as listed in the following options; and specific curriculum requirements as indicated. Courses are generally to be completed in their arranged sequence.

Students in music education must maintain a minimum 2.50 grade-point average in the major and have a 2.20 cumulative average at the time of application for student teaching (February 15 of junior year).

**Freshman Year**

All Options: Engl 401, Freshman English; General Education Requirements—selected science (2 courses), selected social science; Musi 471-472, 473-474.

Option 1. Musi 542 (8 credits).

Option 2. Musi 544 (8 credits).

Option 3. Musi 541 (8 credits); Musi 542 (2 credits); Music Laboratory—Choral (2 credits).

Option 4. Performance Study—major instrument (8 credits); Musi 542 (2 credits); Music Lab—instrumental (2 credits).

Option 5. Musi 542 (2 credits); Performance Study—brass (1 credit); Performance Study—woodwind (1 credit), or Techniques and Methods.

Option 6. Performance Study—major instrument (2 credits); Music Laboratory (2 credits); Techniques and Methods (4 credits); MuEd 500.

**Sophomore Year**

All Options: General Education Requirements—selected social science (2 courses), selected humanities (nonmusic) (2 courses); Musi 571-572, 573-574.

Option 1. Musi 542 (8 credits).

Option 2. Musi 544 (8 credits).

Option 3. Musi 541 (8 credits); Musi 542 (2 credits); Music Laboratory—choral (2 credits).

Option 4. Performance Study—major instrument (8 credits); Musi 524 (2 credits); Music Lab—instrumental, (2 credits).

Option 5. Musi 542 (2 credits); Musi 501-502; Performance Study—strings (1 credit), or Techniques and Methods.

Option 6. Performance Study—major instrument (2 credits); Music Laboratory (2 credits); Techniques and Methods (4 credits); Educ 500 in the place of one science.

**Junior Year**

Options 1-5: General Education Requirements—Foreign language recommended (2 courses).

Option 1. Musi 542 (8 credits); Musi 501-502; Musi 771-772; Musi 455.

Option 2. Musi 544 (8 credits); Musi 501-502; Musi 771-772; MuEd 540 and 741.

Option 3. Musi 541 (8 credits); Musi 542 (2 credits); Musi 501-502; a second foreign language—German, French, or Italian (8 credits); Music Laboratory—choral and/or opera workshop (4 credits).

Option 4. Performance Study—major instrument (8 credits); Musi 501-502; Musi 751-752; Ensemble (2 credits); Music Laboratory—instrumental (2 credits).

Option 5. Musi 771-772; Musi 775-776; Musi 779; Musi 781; Musi 542 (2 credits).

Option 6. Musi 501-502; Musi 751-752; Musi 779; Performance Study—major instrument (3 credits); Music Laboratory (3 credits); Educ 700; Educ 701; and one social science.

**Senior Year**

Option 1. Musi 542 (8 credits); Musi 455; Musi 735; two 4-credit courses elected in advanced theory and literature; two 4-credit courses elected outside the Department of Music.

| | |
|---|---|
| Option 2. | Musi 544 (8 credits); two 4-credit courses in liturgical music, organ literature, repertoire and hymnology; two 4-credit courses in music literature and/or advanced theory; two 4-credit courses elected outside the Department of Music. |
| Option 3. | Musi 541 (8 credits); Musi 542 (2 credits); two 4-credit courses in music literature and/or advanced theory; Music Laboratory—choral, ensemble, and/or opera workshop (4 credits). |
| Option 4. | Performance Study—major instrument, (8 credits); two 4-credit courses in music literature and/or advanced theory; two 4-credit courses elected outside the Department of Music; Music Laboratory—instrumental (2 credits); ensemble (2 credits). |
| Option 5. | Musi 773; Musi 777 (6 credits); Musi 542 (2 credits); two 4-credit courses in music literature; two 4-credit courses elected outside the Department of Music. |
| Option 6. | MuEd 787-788; MuEd 791-792; Educ 705; Educ 694; Performance Study—major instrument (1 credit); Music Laboratory (1 credit); General Education Requirement (two courses, foreign language recommended). |

All students are responsible for adding electives as needed to total a minimum of 128 credits for graduation.

### Women's Studies Minor

The women's studies minor provides students with an interdisciplinary introduction to the status of women in various cultures and historical eras, as well as to the contribution of women to various fields of endeavor. In addition, women's studies courses offer students a critical perspective on such basic questions of the social order as assumptions about gender roles and gender identity.

For the women's studies minor, students must complete 20 credits of women's studies courses. These should include W S 401, Introduction to Women's Studies, and W S 698, Senior Seminar, normally taken at the beginning and end of the course sequence, respectively. In between, students should select courses from departmental offerings that have been designated women's studies courses or that have the approval of the women's studies coordinator.

Such departmental offerings include the following regularly repeated courses: Admn 780, Women in Management; Anthro 625, Female, Male, and Society; Engl 585, Introduction to Women in Literature; Engl 586, Introduction to Women Writers; Engl 685, Women's Literary Traditions; Engl 785, Major Women Writers; and ThCo 567, Images of Women in Media.

Students may complete the minor requirements by selecting from other courses that are offered occasionally by the departments. In the past, such offerings have included the following: Psyc 591-A, Psychology of Women; Econ 698, The Economics of Discrimination and Poverty; Phil 496, Women and Philosophy; ThCo 695-E, The Rhetoric of the Feminist Movement; and others.

Students who wish to minor in women's studies should consult with the coordinator, Dr. Josephine Donovan, 19 Murkland Hall.

# College of Life Sciences and Agriculture

Lincoln C. Peirce, Acting Dean
Avery E. Rich, Associate Dean
Emery P. Booska, Assistant to the Dean

**Departments and Institute**

Animal Sciences
Biochemistry
Botany and Plant Pathology
Entomology
Home Economics
Plant Science
Institute of Natural and Environmental Resources

**Degrees, Majors, and Specializations**

**Bachelor of Arts**

Botany and Plant Pathology
Entomology

**Bachelor of Science**

Animal Sciences
- Animal Science
- Preveterinary Medicine

Biochemistry
Biology
Botany and Plant Pathology
Entomology
General Studies
Home Economics
- Child-Family Studies
- Consumer Studies
- Home Economics Education
- Human Nutrition and Dietetics

Occupational Education
Plant Science

*(within the Institute of Natural and Environmental Resources)*

Community Development
Environmental Conservation
Hydrology
Resource Economics
Soil Science
Wildlife Management

**Bachelor of Science in Forestry**

*(within the Institute of Natural and Environmental Resources)*

Forest Resources
- Forest Management
- Forest Science
- Quantitative Science
- Wood Science

# General Information

## Purposes and Programs

The objectives of the College of Life Sciences and Agriculture are to give students a fundamental education in the biological, physical, and social sciences and to introduce them to the arts and humanities. In addition, specific technical courses are provided in students' interests and majors.

The College offers three undergraduate degrees: the Bachelor of Arts, the Bachelor of Science, and the Bachelor of Science in Forestry.

## Advisory System

A member of the faculty whose area of interest is closely related to the student's is appointed as an adviser to assist the undergraduate in planning his or her academic program.

## Undeclared

Students may select a major upon entering the college or may wait until registration for the sophomore year. Students who are uncertain about choosing a specific major may remain undeclared during their freshman year. In most cases they should take the following courses, after which they should be ready to declare a major:

| Fall | Spring |
|---|---|
| Chem 403 | Chem 404 |
| Bot 411 or Zool 412 | Bot 412 or Zool 412 |
| Psyc 401* | Engl 401 |
| AnSc 401, PlSc 421, or FoRs 423 and 425 | REco 411* |

*or other elective course to meet a Group II requirement.

Undeclared freshmen should explore possible majors by taking courses in the areas or programs that interest them most. They should talk to faculty, students, and their adviser, Dean Rich, concerning requirements, job opportunities, etc., in the various programs and should be prepared to declare a major by April when they preregister for the fall semester of the sophomore year.

## Honors Program

The College of Life Sciences and Agriculture, through its various departments, offers superior students the opportunity to participate in an honors program that is individually designed to provide added intellectual incentives and opportunities. Participation in the honors program is by invitation of a faculty member with the approval of the department concerned and the dean of the college. It is limited to those students entering the sophomore or junior year with at least a 3.00 grade-point average. The recommending faculty member, his or her department chairperson, and the dean will constitute the student's academic advisory committee. This committee and the student will decide upon a suitable academic program. Departmental and college course requirements may be waived for students in the program, who must, however, complete the same number of credits to graduate as other students in the department.

## Combined Programs of Study

In addition to pursuing a single major, students may combine programs of study as follows:

**Minors:** See page 18 for requirements. See also Interdisciplinary Minors, page 55.

**Second Majors:** See page 17 for requirements.

**Dual-Degree Programs:** See page 17 for requirements.

**Student-Designed Majors:** See page 92 for requirements.

Other combined and interdisciplinary opportunities are described in "Special University Programs," page 91.

# Bachelor of Arts

Students majoring in botany and plant pathology or in entomology may elect to earn either a Bachelor of Arts degree or a Bachelor of Science degree. The degree requirements in the College of Life Sciences and Agriculture for the Bachelor of Arts are almost the same as for a Bachelor of Science plus the addition of a foreign language requirement (see page 16 for B.A. degree requirements).

# Bachelor of Science

Many professional careers are open for graduates of the College. There are opportunities for people trained in resource development and conservation, as well as positions in agricultural industries. Emerging countries throughout the world are asking for assistance in all phases of agriculture, including home economics and forestry. In all de-

partments, students may prepare for further graduate work in their respective fields of interest.

Following are additional examples of employing agencies and industries and the careers they offer.

The agricultural industries, food processors, and banks employ graduates as price analysts and managers.

State planning and recreation agencies, soil conservation services, the cooperative extension services, and private research firms employ rural and urban planners, hydrologists, conservation experts, resource development economists, nursery planners, and landscape gardeners.

The Peace Corps and the Foreign Agriculture Service hire farm production experts, soil and water managers, market analysts, agricultural engineers, teachers, plant and animal breeders, and nutrition specialists.

The federal government and state agencies, universities, health services, and private foundations employ biochemists, geneticists, animal nutrition specialists, plant and animal pathologists and physiologists, veterinarians, foresters, home economists, and entomologists.

### Academic Requirements

For the Bachelor of Science degree, a total of 128 credits* is required. In addition, students must complete the General Education Requirements found on page 15, obtain a written recommendation for graduation from their adviser and department chairperson, and achieve a 2.00 cumulative grade-point average for all courses taken at the University of New Hampshire.

Some of the courses prescribed in the following degree programs partially fulfill the General Education Requirements. Students should see their adviser for specific information.

### Five-Year Program: B.S.-M.B.A.

The College of Life Sciences and Agriculture and the Whittemore School of Business and Economics offer a combined five-year program leading to a B.S. in Plant Science and an M.B.A. degree. Information about the program can be obtained from the plant science department or from the undergraduate counselor in the Whittemore School.

*The wildlife management major requires 132 credits.

## Animal Sciences

The animal sciences courses provide students with fundamental scientific training in such specialized areas as genetics, physiology, nutrition, animal hygiene, processing, pathology, and management. Students also have an opportunity to concentrate studies further in the fields of animal, dairy, or poultry science; light horses; preveterinary medicine; or animal biology. The two options are animal sciences and preveterinary medicine.

Outstanding graduates are qualified to pursue advanced study in preparation for college teaching, research, and responsible technical positions in industry and federal and state agencies. Students interested in the production aspects of the animal sciences industry may seek jobs as production managers or positions in the feed or equipment industries, marketing organizations, animal breeding associations, sales and service work in allied industries, and other areas of the diversified animal industry.

The department maintains Morgan and Thoroughbred horses for all phases of classwork, including riding. Herds of Hereford and Angus cattle, Yorkshire swine, and a flock of Dorset sheep are maintained in a new livestock facility.

The nationally recognized dairy herd, consisting of registered Ayrshire, Guernsey, Holstein, and Jersey animals, is housed in a new dairy barn. The Ritzman Animal Nutrition Laboratory includes bomb calorimeters, metabolism stalls for digestion studies, respiration chambers for heat production measurements, and other facilities used in nutrition teaching and research with farm and lab animals.

New poultry farm facilities are for instruction and research and include laboratories for teaching and research in poultry genetics, nutrition, diseases, and management.

Laboratory facilities in Kendall Hall, including such modern equipment as ultracentrifuge, amino acid analyzer, gas chromatograph, and electron microscope, provide the latest scientific training in animal hygiene. Kendall Hall is an entirely new facility, with five floors devoted to offices, classrooms, and laboratories for the Department of Animal Sciences.

The department works closely with the New Hampshire animal industry, and frequent class trips are made to leading

farms, industrial concerns, processing plants, etc., where opportunities are available for viewing industry in action.

Undergraduates who contemplate veterinary medicine as a career should confer early with the adviser to preveterinary medicine students. It should be noted that all veterinary colleges give first preference for admission to applicants from their respective states. Out-of-state students who are admitted must show above-average scholastic ability. It is desirable that applicants to colleges of veterinary medicine have some farm experience; in fact, it is a prerequisite for admission to some.

The following courses are required of animal sciences majors: AnSc 401 and 506, Chem 401-402 or 403-404, Bchm 501, Bot 411 (or 412) or PlSc 421, Zool 412, and Zool 504 or Zool 604. In addition, several animal sciences courses should be selected, depending on the students' particular interests.

Preveterinary students take most of the above courses plus special courses that prepare them for veterinary school.

## Biochemistry

Biochemistry is the study of chemistry of living things and of life processes. The program in biochemistry provides a fundamental education in chemistry and the biological sciences and includes basic courses in physics and mathematics.

Two curricula are offered to meet the educational requirements of students with differing professional goals.

**Biochemistry Curriculum A** provides intensive preparation in chemistry and biochemistry and basic courses in botany, zoology, microbiology, and genetics. This curriculum is recommended for students preparing for graduate study or for admission into professional schools of medicine, dentistry, or pharmacy. Students entering the curriculum should register for Chem 405-406, Math 425-426, Bot 411, and Zool 412 in the freshman year.

**Biochemistry Curriculum B** provides a fundamental education in chemistry and the biological sciences with enrichment in biochemical specialties including medical, analytical, marine, and nutritional biochemistry. It provides a strong educational background for technical employment in research and service programs of universities, medical schools, hospitals, research institutes, and industrial or government laboratories. Students entering this curriculum should register for Chem 403-404, Bchm 402, Bot 411, and Zool 412 in the freshman year.

Students interested in a biochemistry major are advised to consult with the department chairperson as early as possible to assure the most effective curricular planning.

## Biology

The interdepartmental biology major is described in the chapter on Special University Programs.

## Botany and Plant Pathology

The botany and plant pathology program explores the fundamental nature of plants. Botany graduates with suitable undergraduate backgrounds may enter the field of secondary education or become research technicians. Those students who have an interest in university teaching and/or research, governmental research, and certain kinds of industrial positions should expect to complete graduate education in the field.

The principal areas of concentration in the department are: 1) plant physiology, 2) cell biology, 3) ecology, 4) phycology, 5) biological oceanography, 6) plant pathology, 7) systematic botany, 8) plant anatomy and morphology, 9) mycology, and 10) morphogenesis.

Two botany and plant pathology degrees are offered: Bachelor of Science and Bachelor of Arts. All undergraduate botany majors are required to take the following core of botany courses: 411, General Botany, or 412, Introductory Botany (or equivalent); 503, The Plant World; 566, Systematic Botany; 606, Plant Physiology; and 658, Plant Anatomy, or 762, Morphology of the Vascular Plants. Also required are two botany electives, Zool 412, and one year of chemistry. These courses cannot be used to fulfill Group I requirements. Majors must maintain a grade of C- (1.67) or better with a grade-point average of 2.00 in required courses. Beyond that, the program of each individual is selected by the student and adviser to meet particular needs.

Students interested in majoring in botany and plant pathology are invited to consult with Associate Professor A. Linn Bogle.

## Entomology

The Department of Entomology offers courses for students who wish to specialize in the study of insects and noninsect terrestrial arthropods, insect pest management, and insects in relation to people. There are employment opportunities for graduates in federal and state agencies, public institutions, and commercial and industrial firms in the areas of crop protection, forestry, conservation, and public health.

Students receive a fundamental education in the major fields of entomology, including general biology of insects and other arthropod groups, forest entomology, economic entomology, medical entomology, insect morphology, physiology, taxonomy, and insect pest management. Those who wish to specialize in chemical control of insects are expected to take courses in mathematics and chemistry. Outstanding students are encouraged to pursue graduate study.

Entomology majors are expected to complete 32 semester credits successfully in courses offered by the department. Courses in other departments may be taken in lieu of the above with the consent of the major adviser. Majors are required to take the following courses: Ento 402, 503; Bot 411 or 412; Zool 412; Chem 403-404; and 545(6) or Bchm 501, plus four courses from the following: Bot 566, 606, 751, 754; INER 528; Micr 501 (and 502) or 503; PISc 421, 607, 651, 652, 653, 654; Zool 528, 721.

Students may earn either a Bachelor of Science or Bachelor of Arts degree in entomology.

Those contemplating a career in entomology are advised to consult with the chairperson of the Department of Entomology.

## General Studies

General studies is a flexible, loosely structured curriculum for students with a broad, general interest in several areas of life sciences and agriculture. It cuts across departmental lines and in some respects resembles a self-designed major. It is not intended to be a catch-all for students from other colleges but is designed to serve the needs of Life Sciences and Agriculture students. Students majoring in general studies should take Chem 403-404, Zool 412, and Bot 411, 412, or PISc 421. Six additional courses in the college (or closely related courses approved by the adviser), two of which must be at the 600 level or above, are required. These courses should be interrelated in such a way that they will help students meet their goals for employment or further study.

Freshmen who are unsure of a major should not declare general studies as a major but should remain undeclared for a semester or two. See page 41.

## Home Economics

The objectives of the program in home economics are to provide a broad general education in the social and natural sciences, the humanities, and the arts and to provide specialized instruction based on these disciplines as preparation for professional careers in which the interests and well-being of the individual, the consumer, and the family are paramount.

The department provides professional preparation for men and women through four options: 1) child-family studies; 2) consumer studies; 3) home economics education; and 4) human nutrition and dietetics.

The department has been approved by the New Hampshire State Board of Education for the preparation of nursery-kindergarten and secondary school teachers in vocational home economics and family-life programs. Requirements for some professional programs make it advisable for students to specify an option as soon as possible, and by the sophomore year at the latest.

Candidates for the degree of Bachelor of Science must complete 32 courses or a minimum of 128 credits with an average of C (2.00) or better, distributed as follows: University General Education Requirements, 16 courses or 64 credits; professional or specialized education requirements, 16 courses or 64 credits. The latter must include a minimum of nine courses or 36 credits in home economics. Undergraduates are required to take a minimum of four credits from each of the three major subject matter areas (food-nutrition, child-family, and consumer studies) offered by the department. Upon selection of a program option, students, in consultation with their advisers, will select the remaining six courses (24 credits) from among those offered

in the department that relate to their particular fields of interest. Specialized education requirements also include three courses or 12 credits in one of the related social sciences or natural sciences numbered 500 or above, and four courses or 16 credits for professional preparation (to be selected in consultation with the adviser). These final four courses may help students meet certification standards for secondary school teaching, preschool teaching, ADA requirements for a dietetic internship, or other objectives. Students seeking nursery-kindergarten teacher certification must apply through the Department of Home Economics for acceptance into student teaching by spring semester of the junior year. Students seeking secondary home economics certification must apply through the Department of Education. See page 25 for information.

Students wishing to major in the Department of Home Economics are advised to consult with the department chairperson as early as possible. Further information about specific programs may be obtained by contacting the department.

## Institute of Natural and Environmental Resources

The Institute of Natural and Environmental Resources (INER) is a multidisciplinary unit with approximately 25 faculty and 650 students in seven undergraduate and six graduate programs. The organization of the institute, without conventional departments, provides an environment for faculty and students to learn about the relationships between people and natural resources. The seven undergraduate programs are: Community Development, Environmental Conservation, Forest Resources, Hydrology, Resource Economics, Soil Science, and Wildlife Management.

## Community Development

The Community Development Program deals with broad aspects of community problem resolution, including economic, social, political, and technical matters. Communities are viewed as systems subject to meaningful analysis, and emphasis is placed on the community development process of helping people learn how to work together, organize their efforts, and analyze community problems in a democratic, decision-making framework. The curriculum takes an interdisciplinary approach, and includes field experience as a vital component, along with classroom and independent study.

The core courses in the curriculum provide students with the basic community development tools. Flexibility is added through electives that permit students to specialize and develop strong minors in areas such as conservation, planning, education, administration, pollution and waste disposal, natural resource management, or resource economics. Opportunities are available for directed field experience.

While this program is suitable for preparing citizens for more effective leadership in their community, employment opportunities are available in the United States, Canada, and in emerging nations. Many federal and local agencies are now undertaking revenue-sharing and community assistance programs and need personnel who are trained to apply the arts and sciences to the problems of communities. Similarly, many private and local groups are concerned with community planning and development.

Students interested in a community development major or minor may consult with the program coordinator, Associate Professor Edmund F. Jansen, Jr., James Hall, or with the director of the Institute.

**Required Courses**

| | | |
|---|---|---|
| INER | 401* | Natural and Human Resources of New England |
| REco | 507 | Introduction to Community Development |
| REco | 508 | Applied Community Development |
| REco | 795 or 796 | Independent investigation in field analysis of a specific problem in a community in the region |

**At Least Five of the Following:**

| | | |
|---|---|---|
| Admn | 712 | Organizational Change |
| Admn | 713 | Interpersonal and Group Dynamics |
| Biol | 541 | General Ecology |
| INER | 528 | Applied Statistics I |
| INER | 702 | Natural Resources Policy |
| INER | 709 | Soils and Community Planning |
| REco | 614 | Community Planning |
| REco | 705 | Planned Change in Nonmetropolitan Communities |

*Required for freshmen only.

| | | |
|---|---|---|
| REco | 717 | Law of Community Planning |
| Soc | 500 | Social Psychology |
| Soc | 560 | Rural-Urban Sociology |
| Soc | 745 | Social Stratification |

**Courses to Satisfy General Education Requirements**

**Biological and Physical Sciences and Mathematics:**

| | | |
|---|---|---|
| Bot | 411 or | General Botany or |
| Bot | 412 | Introductory Botany |
| Math | 420 | Fundamental Mathematics |

Two Additional Courses Selected by Student

**Arts, Humanities, and Social Sciences:**

| | | |
|---|---|---|
| REco | 411 | Introduction to Resource Economics |
| REco | 506 | Population, Food, and Resource Use In Developing Countries |
| or | | |
| REco | 606 | Land Economics and Use |
| Polt | 503 | Local Government and Politics |
| Soc | 400 | Introductory Sociology |

Two Additional Courses Selected by Student

**Outside Major Department:**

| | | |
|---|---|---|
| Engl | 401 | Freshman English |
| Engl | 501 | Introduction to Prose Writing |
| ThCo | 403 | Public Speaking |

Three Additional Courses Selected by Student

**General Electives**

At Least Seven Courses (28 Semester Hours) Selected by Student

## Environmental Conservation

The program in environmental conservation gives a broad background for understanding environmental and resource problems and their solutions. Economic activity within our biological ecosystems requires understanding of both subject-matter areas, and development of policies and planning is essential to resolving environmental problems.

Students must develop a concentration related to career goals. The concentration consists of eight courses selected with the assistance of the faculty adviser from the offerings of the University. Concentrations center on a variety of conservation-related areas, such as land-use planning, ecological education, pollution control, writing about natural resources, etc. In addition, students must complete the 12 courses listed below, which make up the core of the environmental conservation program.

A minor of five courses in environmental conservation is available for students majoring in other areas. Permission is required.

**The following 12 courses are required of all majors:**

| | | |
|---|---|---|
| INER | 401* | Natural and Human Resources of New England |
| Bot | 411 or | General Botany |
| Bot | 412 | Introductory Botany |
| Zool | 412 | Principles of Zoology |
| Ecology electives | | Two of the following: Biol 541, General Ecology; Bot 741, Ecosystem Analysis; Bot 742, Physiological Ecology; FoRs 527, Silvics; FoRs 634, Wildlife Ecology; FoRs 672, Ecological Energetics |
| REco | 411 | Introduction to Resource Economics |
| REco | | An advanced course in the economics of resources |
| INER | 635 | Contemporary Conservation Issues |
| INER | 702 | Natural Resources Policy |
| Hydr | 504 | Freshwater Resources |
| INER | 637 | Practicum in Environmental Conservation: 4 credits. This practicum will be an independent project involving field work on an actual conservation activity during the senior year. A written report will be required. The project may be developed with any faculty member in the Institute of Natural and Environmental Resources. |
| Speaking or writing course | | A speaking skills course or a writing skills course (beyond Freshman English) |

*Required of freshmen only.

Students should plan to work for a master's degree if they wish to be professional conservationists. The undergraduate degree offers an education in environmental conservation with the opportunity for specialization or generalization in related fields.

All students must complete the University General Education Requirements.

Students interested in a major may consult with the program coordinator, Associate Professor John Carroll, James Hall, or with the director of the Institute.

## Forest Resources

The Forest Resources Program, which is accredited by the Society of American Foresters, has the objective of combining a basic education with technical forestry education to meet the needs of professional foresters.

Professional foresters are employed in a variety of forestland management and wood utilization positions. Some graduates work with natural resource protection and the improvement of environmental quality. Others are employed in the production and utilization of raw materials; still others become involved with wildlife, watershed, and recreation management.

Managerial and administrative skills are required of most professional foresters. This program provides a foundation in biological knowledge and managerial skills, with elective freedom to cultivate special abilities and interests. The curriculum leads some students into graduate studies, for which they have been prepared in the undergraduate program.

Students majoring in forest resources complete 137 credit-hours for the degree of Bachelor of Science in Forestry. The University's General Education Requirements are met by taking the required courses listed in the accompanying chart and by choosing electives from the following: four courses in the arts, humanities, and social sciences; and four courses other than those listed under forest resources.

In addition to the normal University fees and tuition, forest resources students are required to pay certain course transportation fees and the cost of meals in connection with some planned field sessions.

*All* of the following freshman and sophomore courses, or their equivalencies, must be completed before entry into any of the junior and senior forestry courses: Dendrology, Identification of Trees and Shrubs, Freshman English, General Botany, Calculus I, Wood Science and Technology, Principles of Economics, Writing (or Speaking), Silvics, Soils and the Environment, Computer Methods, Applied Statistics, Forest Economics, and Forestland Measurement and Mapping. Junior and senior forestry program courses include: Silviculture, Forest Fire Protection, Forest Mensuration, Forest Resources and Measurement Mapping, Forest Management, Forest Resource Management Seminar, and Wood Products Manufacture and Marketing.

In addition to these formal courses, all forestry majors are required to have at least one summer of forestry work experience (FoRs 500). Students are responsible for their own summer work, though assistance is available from the faculty.

Before the junior year, students must choose a single area of concentration from the following options, and must earn 24 credits within that concentration.

### Forest Management Option

One course at the 500 level or above in accounting, management, or administration in the Whittemore School; FoRs 753, Operations Control and Analysis; and four additional courses (16 credits) in advanced forestry, wildlife, hydrology, soils, resource management, or administration.

### Forest Science Option

Chem 404, General Chemistry; Bchm 501, Biological Chemistry, or Bchm 601, General Biochemistry; Zool/PlSc 604, Principles of Genetics; and PlSc 606, Plant Physiology; and two courses in advanced plant science, botany, or entomology.

### Wood Science Option

Chem 404, General Chemistry; Math 426, Calculus II; two courses in FoRs 695-696 (Section C), Investigations in Wood Products; and two courses in advanced mathematics, science, or engineering.

### Quantitative Science Option

Math 426, Calculus II; Math 527, Differential Equations with Linear Algebra, or Math 528, Multidimensional Calculus; Math 645, Applied Linear Algebra; a course in probability or statistics; and two courses in advanced mathematics, statistics, or computer science.

| Freshman Year | | Fall | Spring |
|---|---|---|---|
| INER 401* | Natural and Human Resources of New England | 2 | |
| FoRs 423 | Dendrology | 2 | |
| FoRs 425 | Identification of Trees and Shrubs | 2 | |
| FoRs 426 | Wood Science and Technology | | 4 |
| Engl 401 | Freshman English | 4 | |
| Bot 411 or 412 | General Botany or Introduction to Botany | 4 | (4) |
| Math 425 | Calculus I | 4 | |
| Econ 401 or REco 411 | Principles of Economics or Introduction to Resource Economics | (4) | 4 |
| Advanced English | Writing or Speaking Development | | 4 |
| Elective | | | 4 |
| | | 18 | 16 |
| **Sophomore Year** | | | |
| Science Elective | Chem 403, ESci 401, or Phys 401 | 4 | |
| Ento 507 or Bot 753** | Forest Entomology or Forest Pathology | | 4 |
| FoRs 527 | Silvics | 4 | |
| INER 528 | Applied Statistics I | | 4 |
| Soil 501 | Soils and the Environment | 4 | |
| FoRs 544 | Forest Economics | | 4 |
| Computational | C S 403 or INER 511 | 2 | |
| FoRs 542 | Forestland Measurement and Mapping | | 2 |
| Elective | | 4 | 4 |
| | | 18 | 18 |

*Suggested for freshmen only.
**Bot 753 requires junior standing.

| Junior Year | | | |
|---|---|---|---|
| FoRs 629 | Silviculture | 3 | |
| FoRs 644 | Forest Mensuration | | 4 |
| FoRs 652 | Forest Resources Measurement and Mapping | | 2 |
| FoRs 660 | Forest Fire Protection | | 2 |
| Electives | | 14 | 10 |
| | | 17 | 18 |
| **Senior Year** | | | |
| FoRs 500*** | Summer Work Experience | 0 | |
| FoRs 745, 798 | Forest Management, Forest Resources Management Seminar | 4 | 4 |
| FoRs 754 | Wood Products Manufacture and Marketing | | 4 |
| Electives | | 12 | 8 |
| | | 16 | 16 |

***Open to all classes, may be repeated.

Students interested in the forest resources program may consult with the program coordinator, Professor Bennett Foster, James Hall, or with the institute director.

## Hydrology

Hydrology is the science underlying development and control of water resources on and beneath the earth's surface. Because water is a basic requirement of life, it has social, economic, and political significance throughout the world. As the population of the world grows and as industrial, recreational, agricultural, and residential needs for water increase, greater emphasis will be placed on the study and understanding of problems associated with water resources.

**Core courses expected of majors are:**

| | | |
|---|---|---|
| Chem | 403-404 | General Chemistry |
| Phys | 407-408 | General Physics I and II |
| Bot or PlSc | 411 or 412<br>421 | General or Introductory Botany<br>Concepts of plant growth |
| C S | 410 | Introduction to Computer Programming |
| Math | 425,426 | Calculus I and II |

| | | |
|---|---|---|
| ESci | 401 | Principles of Geology I |
| Soil | 501 | Soils and the Environment |
| ESci | 561 | Geomorphology |
| Math | 527 or | Differential Equations with Linear Algebra |
| INER | 528 | Applied Statistics I |
| or equivalent | | |
| INER | 757 | Basics of Remote Sensing |
| Hydr | 603 | Hydrology and Water Management |
| Hydr | 705 | Principles of Hydrology |
| Hydr | 710 | Groundwater Hydrology |

Students interested in the hydrology program may consult with the program coordinator, Professor Gordon Byers, Pettee Hall, or with the institute director.

## Resource Economics

This program offers training in resource economics, including public resource policy, resource management, conservation economics, and regional economics. Training is also available in agricultural economics, including farm management, food marketing, agricultural policy, and world food supplies.

Students in resource economics receive training primarily in the science of economics and its use in problem-solving by individuals, households, business firms, communities, and administrators of governmental agencies. In addition, students must satisfy General Education Requirements, which lead to a broad university education. Majors interested in the economic or business aspects of agriculture will be expected to take courses in the animal sciences and plant science departments.

Students majoring in the social sciences and life sciences and agriculture departments of the University may find it to their advantage to elect courses or a minor in resource economics. By doing so, their basic training can be supplemented in a specific area of interest, such as farm management and agricultural marketing for agricultural majors, or resource development and natural-resource policy for social science majors.

**Required Courses**

**All of the following:**

| | |
|---|---|
| Engl 401 | Freshman English |
| Soc 400 or | Introductory Sociology |
| Polt 401 | Politics, Morality, and Community |
| ThCo 403 | Public Speaking |
| Admn 502 | Financial Accounting |
| Bot 411 | General Botany* |
| Zool 412 | Principles of Zoology* |
| Soil 501 or | Soils and the Environment* |
| Hydr 504 | Freshwater Resources* |
| INER 401** | Natural and Human Resources of New England |
| REco 411 | Introduction to Resource Economics |
| Math 420 or 425 | Fundamental Mathematics or Calculus I |
| Econ 605 | Intermediate Microeconomic Analysis |
| Econ 611 | Intermediate Macroeconomic Analysis |
| INER 528 or | Applied Statistics I |
| INER 701 | Statistical Methods I |

**At least six of the following:**

| | |
|---|---|
| REco 501 | Agricultural and Natural Resource Product Marketing |
| REco 504 | Management of Farm and Related Resource-Based Business |
| REco 506 | Population, Food, and Resource Use in Developing Countries |
| REco 507 | Introduction to Community and Community Development |
| REco 606 | Land Economics and Use |
| REco 611 | Marine Resource Economics |
| REco 676 | Economics of Water Use and Quality Management |
| REco 706 | Economics of Resource Development |
| REco 710 | Resource Economics Seminar |
| REco 756 | Regional Economic Analysis |
| INER 615 | Linear Programming Methods |

*or equivalent to satisfy General Education Requirements
**Required for freshmen only.

Students who major in resource economics are qualified for a wide variety of opportunities upon graduation. Private business, public institutions, and government agencies currently have a strong demand for specialists trained in agricultural, fisheries, and forestry marketing; conservation resource development, community development, and land-use policy; extension work; resident teaching; and farm management. In many cases, students may wish to improve their qualifications by pursuing more specialized graduate studies in one or more of the above areas.

Students interested in a major or minor in resource economics may consult with the program coordinator, Professor Richard Andrews, James Hall, or with the institute director.

## Soil Science

Soil science is the study of the nature and properties of soils, as well as of their importance to modern society. It includes the study of the chemical and physical properties of soils, their formation, classification, conservation, and management. Soils are evaluated as a resource in urban and rural community planning, as well as for food and fiber production.

Graduates of the soil science program are academically qualified for many positions in the public and private section of our economy. For example, the increasing urbanization of the Northeast is creating a demand for professional soil scientists who are competent to assess the capability of soils to support development. In addition, the associated demand for fiber is expanding the role of soils scientists capable of working with foresters in planning for more intensive utilization of our forest resources.

The following are the core courses normally required of majors. Electives permit freedom to tailor training to specific interests and professional goals.

**Core Courses**

| | | |
|---|---|---|
| INER | 401* | Natural and Human Resources of New England |
| Chem | 403-404 | General Chemistry |
| Chem | 517 | Quantitative Analysis |
| Phys | 407-408 | General Physics I and II |
| C S | 410 | Introduction to Computer Programming |
| Math | 425,426 | Calculus I and II |
| ESci | 401 | Principles of Geology I |
| ESci | 762 | Glacial Geology |
| Bot | 412 | Introductory Botany |
| Bot | 606 | Plant Physiology |
| Soil | 501 | Soils and the Environment |
| Soil | 502 | Soil-Plant Relationships |
| Soil | 602 | Chemical Analysis of Soil |
| Soil | 702 | Chemistry of Soils |
| Soil | 704 | Soil Classification and Mapping |
| Soil | 795,796 | Independent Work in Soil Science |
| Micr | 503 | General Microbiology |
| Micr | 708 or | Microbial Biogeochemistry |
| Micr | 712 | Soil Microbiology |

*Required of freshmen only.

Students interested in the soil science major should consult with Associate Professor Nobel Peterson or with the institute director.

## Wildlife Management

The wildlife management curriculum is for students whose interest is in the understanding, production, management, and utilization of game and other forms of wildlife. The curriculum provides a knowledge of wildlife species and of the total forest and field environment of which they are a part. It also prepares students for possible employment with public and private agencies in wildlife management and ecology, and is a base for graduate study, which is needed for research and teaching.

The degree earned is a Bachelor of Science with a major in wildlife management. The program, administered in the Institute of Natural and Environmental Resources, is operated in cooperation with the animal sciences and zoology departments.

Field work is carried out during the academic year on wildlife areas near the campus. Each June, a two-week session is held for all students who have completed the sophomore year. There is no additional summer camp. In addition to the normal University fees and tuition, students are required to pay transportation and meal charges in connection with regularly planned field sessions. Majors are encouraged to obtain summer employment related to their career objective.

Students majoring in wildlife management are required to complete 132 credits for the bachelor's degree. In completing the curriculum, listed below, students will meet the University General Education Requirements. These requirements should be met by choosing electives as follows: six courses in the arts, humanities, or social sciences; and four courses from the other General Education Requirements. Two electives should be chosen from additional resource-oriented courses such as: FoRs: 544, Forest Economics; 629, Silviculture; 644, Forest Mensuration; 672, Ecological Energetics; 745, Forest Management; Soil: 501, Soils and the Environment; 502, Soil-Plant Relationships; Hydr 504, Freshwater Resources; and INER: 702, Natural Resources Policy; 712, Sampling Techniques; 797, Forest Recreation Seminar.

| Freshman Year | | Fall | Spring |
|---|---|---|---|
| INER 401* | Natural and Human Resources of New England | 2 | |
| Bot 411 | General Botany | 4 | |
| Zool 412 | Principles of Zoology | | 4 |
| FoRs 423 | Dendrology | 2 | |
| FoRs 425 | Identification of Trees and Shrubs | 2 | |
| Math 420 or | Fundamental Mathematics | | 4 |
| Math 425 | Calculus I | | |
| Engl 401 | Freshman English | 4 | |
| REco 411 | Introduction to Resource Economics | | 4 |
| Electives | | 4 | 4 |
| | | 18 | 16 |
| **Sophomore Year** | | | |
| AnSc 501 | Animal Anatomy and Physiology | 4 | |
| INER 635 | Contemporary Conservation Issues | 4 | |
| Chem 403-404 | General Chemistry | 4 | 4 |
| INER 528 | Applied Statistics I | | 4 |
| Zool 542 | Ornithology | | 4 |
| Electives | | 4 | 4 |
| | | 16 | 16 |
| **Spring Field Session (June)** | | | |
| FoRs 542 | Forestland Measurement and Mapping | 2 | |
| **Junior Year** | | | |
| Bchm 501 | Biological Chemistry | 4 | |
| Zool 712 | Mammalogy | 4 | |
| Biol 541 | General Ecology | 4 | |
| FoRs 634 | Wildlife Ecology | | 4 |
| AnSc 614 | Diseases and Parasites of Wildlife | | 4 |
| Polt 401 | Politics, Morality, and Community or | | |
| or 402 | American Politics and Culture | | 4 |
| C S 403 or | Introduction to Digital Computer Programming | 2 | |
| INER 511 | Computation Methods in Natural Resources | 2 | |
| Electives | | 4 | 4 |
| | | 18 | 16 |
| **Senior Year** | | | |
| FoRs 737, 738 | Game Management I and II | 4 | 4 |
| Zool 711 | Natural History of Cold-blooded Vertebrates | 4 | |
| Zool 772 | Fisheries Biology | | 4 |
| Electives | | 8 | 8 |
| | | 16 | 16 |

*Required of freshmen only.

Students interested in the wildlife management major may consult with the program coordinator, Professor William Mautz, Pettee Hall, or with the institute director.

## Occupational Education

The occupational education curriculum provides professional preparation for teachers of vocational-technical education and county Cooperative Extension personnel. Flexibility is maintained among individual programs with up to 30 credits being allowed for qualified students under the occupational competency testing and evaluation program.

Career choices are varied, with graduates teaching in nearly all areas of vocational-technical education positions through participation in field experiences, in addition to coursework.

Students desiring to major or minor in occupational education should consult with the program chairperson, Associate Professor Nicholas L. Paul.

## Plant Science

Students interested in plants and their use for food, feed, fiber, recreation, or ornamental purposes may major or minor in plant science. A core curriculum of physical and biological sciences is required. Students may then select courses which relate these sciences to their specific interests. Two curriculum options, the science option and

the general option, are offered to plant science majors. The following courses or their equivalents are required for these options:

| | | Science Option | General Option |
|---|---|---|---|
| PISc 421 | Concepts of Plant Growth | x | x |
| PISc 522 | Environment and Plant Response | x | x |
| PISc or Zool 604 | Principles of Genetics | x | x |
| PISc 606 | Plant Physiology | x | x |
| PISc 566, 651, 652, 653, 654, or 678 | Elective in Crop Production | | x |
| PISc 795 or 796 | Elective in Special Topics | x | |
| Math 405 or 425-426 | Elementary Functions or Calculus I and II | x | |
| Phys 401-402 | Introduction to Physics I and II | x | |
| Chem 403-404, 545-546 | General and Organic Chemistry | x | x |
| Micr 503 | General Microbiology | x | |
| Ento 402 | Introductory Entomology | x | x |
| Soil 501 | Soils and the Environment | x | x |
| Bot 412 or 503 | Introductory Botany or The Plant World | x | x |
| Bot 751 or 753 | Plant Pathology or Forest Pathology | x | x |
| INER 528 or 701 | Statistics | x | |

Because of the diversity of employment possibilities, the general option curriculum is flexible. Minor programs in administration, economics, English (journalism), recreation and parks, or occupational education can be tailored to accommodate specialized interests and complement fundamental requirements. Students will find opportunities in management of farms, greenhouses, golf courses, or nurseries; teaching; journalism; park or highway planning commissions; sales or brokerage aspects of wholesale and retail marketing; and food and feed processing firms. Students pursue the science option to prepare for graduate study and careers in research or teaching.

### Five-Year, Dual-Degree Program in Plant Science and Business Administration

A 5-year dual degree program leading to a B.S. degree in plant science and an M.B.A. degree in business administration is also available. Superior students preparing for management of agricultural enterprises should notify the department of their interest in their sophomore year. They will be considered for Graduate School enrollment in their junior year.

Students interested in a plant science major or minor may consult with the acting department chairperson, Professor Owen M. Rogers.

# College of Engineering and Physical Sciences

Richard S. Davis, Dean
Donald W. Melvin, Associate Dean
Donald A. Moore, Assistant to the Dean, Director of Center for Industrial and Institutional Development

**Departments**

Chemical Engineering
Chemistry
Civil Engineering
Earth Sciences
Electrical and Computer Engineering
Mathematics and Computer Science
Mechanical Engineering
Physics

**Programs of Study**

**Bachelor of Science**

Chemical Engineering*
- Energy
- Environmental Engineering

Chemistry*

Civil Engineering*
- Environmental Engineering
- Constructed Systems

Computer Science*

Electrical Engineering*
- Computer Engineering
- Electrical Engineering Systems
- Electrical Engineering Science

Geology*

Mathematics*

Mathematics Education*
- Elementary
- Secondary

Mathematics (Interdisciplinary)
- Mathematics—Chemistry
- Mathematics—Computer Science
- Mathematics—Economics
- Mathematics—Electrical Science
- Mathematics—Fluid Dynamics
- Mathematics—Mechanics
- Mathematics—Thermodynamics
- Mathematics—Physics

Mechanical Engineering*
- Energy

Physics*

*Designated degree

**Bachelor of Arts**

Chemistry
Chemistry and Physics Teaching
Earth Science Teaching
Geology
Mathematics
Physics
Science

**Bachelor of Engineering Technology**

Electrical Engineering Technology
Mechanical Engineering Technology

## General Information

The College of Engineering and Physical Sciences seeks to provide an optimal opportunity for students to achieve educational objectives appropriate to their interests in engineering, mathematics, and the physical sciences. The college offers a vigorous professional education in each of its nine primary disciplines leading to the Bachelor of Science, and a broad liberal education coupled with majors in mathematics and each of the three physical sciences leading to the Bachelor of Arts. All programs include an opportunity for study in the arts, humanities, and social sciences.

The key to an undergraduate program in the college is flexibility, with a strong emphasis on personal and individualized education. In addition to specific programs, a number of suboptions are available. Special programs can be developed to meet the specific interests of individual students.

Math 425 and 426 or the equivalent in transfer credits or advanced placement approved by the Department of Mathematics and Computer Science are required by all departments of the college for their majors.

### Bachelor of Science

The programs leading to the Bachelor of Science degree, offered in each of the departments of the college, emphasize the preparation of students for a professional career and continuing or graduate education.

The degree requirements for the Bachelor of Science include the University General Education Requirements (page 15) and the specific departmental requirements for graduation. A minimum grade-point average of 2.00 must be achieved. Graduation credit requirements established by the departments range from 128 to 138. Since there is a similar core of courses in each curriculum, it is possible for students to change their field of study during the sophomore year with little effect on the time required for graduation.

### Bachelor of Arts

Programs leading to a Bachelor of Arts degree are offered in the departments of chemistry, earth sciences, mathematics, and physics. These programs provide a broad liberal education along with a major in one of these fields. Students interested in science, but undecided about the field, may enter the college as a science major. The University requirements for the Bachelor of Arts degree are on page 16.

### Bachelor of Engineering Technology

The Engineering Technology program emphasizes applied engineering in two curricula, electrical and mechanical technology. The program enables the student with an appropriate associate degree from an accredited technical institute to obtain a B.E.T. degree in electrical or mechanical engineering technology in two years at UNH. This program emphasizes design and applications and uses the latest techniques and equipment. Student projects and liaisons with New Hampshire industries further enrich the program.

### Five-Year Program: B.S.-M.B.A.

The College of Engineering and Physical Sciences and the Whittemore School of Business and Economics offer a joint program leading to a Bachelor of Science (B.S.) in chemical engineering, civil engineering, electrical engineering, or mechanical engineering and a Master of Business Administration (M.B.A.) in five years rather than the normal six. In order to receive both degrees in five years, students in the program may have to take more than 16 credits per semester in several semesters (though no more than five courses or 20 credits). Provision has been made to count 12-24 credits towards both undergraduate and graduate degree requirements. All other University and departmental requirements for each degree must otherwise be met.

The program first "pre-admits" qualified students to take one M.B.A. course in each semester of their junior year. The pre-admission process should be completed by April 1 of the sophomore year. The program is carried out jointly by representatives from the Whittemore School and the College of Engineering and Physical Sciences. Juniors enrolled in the program should submit a formal application to the Graduate School (in the second semester of the junior year) in order to be admitted to the M.B.A. program by

March 1; they will be judged by academic standards with special emphasis on maturity and experience.

Most of the fourth year is occupied by core M.B.A. courses, while the fifth year is used for M.B.A. electives (some of which might be taken in the undergraduate major department) and for completing all requirements for the undergraduate degree. The M.B.A. will be granted only if the bachelor's degree requirements are successfully completed.

The details of each student's curriculum are worked out jointly with the departmental undergraduate B.S. adviser and with an adviser for the M.B.A. program.

## Interdisciplinary Minors

Interdisciplinary minors have been developed in ocean engineering, oceanography, biomedical systems and instrumentation, environmental engineering, and materials science. These programs will enable students to obtain experience in the specialized area and to retain identification with their major professional area. (For University requirements, see page 18.)

### Ocean Engineering

The ocean engineering minor recognizes undergraduate engineering students who acquire a nucleus of knowledge about engineering pertaining to the ocean and the coastal zone.

Students must satisfactorily complete five courses from the following list: ESci 501, Introduction to Oceanography; ESci 752, Chemical Oceanography; ESci 758, Introduction to Physical Oceanography; ESci 759, Geological Oceanography; E E 781, Ocean Instrumentation Project; E E 785, Underwater Acoustics; M E 737, Ocean Mechanics I; M E 738, Ocean Mechanics II; M E 751, Naval Architecture in Ocean Engineering; M E 752, Submersible Vehicle Systems Design; M E 757, Coastal Engineering and Processes; Tech 610, Introduction to Ocean Engineering; and Tech 697, Ocean Projects. Ordinarily, students must take ESci 501, Tech 697, and three additional courses from the above list, two of which must be engineering courses.

Students wishing to take the ocean engineering minor should indicate their interest to their department chairperson no later than the beginning of the junior year. They will be assigned to their departmental ocean minor adviser, who will assist in planning courses.

### Materials Science Minor

The minor is open to all students of the University. It offers a broad introduction to materials science. The minor is administered by the Department of Mechanical Engineering. Students should contact the minor supervisor by mid-semester of their junior year.

The students must complete five courses as follows. Required courses ME 561 with ME 561L or CE 622 with Lab. Two courses from the group ME 760, ME 766, and Chem 545. Additional courses from the group ME 760, 761, 763, 766, ESci 512, 613, Chem 517, 518, 545, Phys 618.

### Biomedical Systems and Instrumentation

The biomedical systems and instrumentation minor encompasses the application of engineering science and technology to the fields of medicine and biology. Biomedical engineers participate in the development of medical instrumentation, physiological sensors, prosthetic devices, orthopedic and surgical devices, biomaterials, patient safety, and in the applications of computers to medical problems. Biomedical engineers may continue their studies at the graduate level and find employment in biomedical research, as practically-oriented clinical engineers in hospitals or other clinical settings, or with the medical device and instrument industry.

Engineering students electing this minor must select E E 783, Biomedical Engineering, and either E E 784, Biomedical Instrumentation, or, for students who lack a background in electronics, an appropriate special independent study course approved by both the student's adviser and the chairperson of the Biomedical Systems and Instrumentation Minor Committee. Additionally, three other courses must be selected, in consultation with the student's adviser, from the list below. Since many of these courses have prerequisites, students should begin the program during their sophomore year. During the final semester, application should be made to the dean to have the biomedical systems and instrumentation minor shown on transcripts.

**Engineering Electives:** E E 714, Minicomputer Applications Engineering, with an appropriate choice of topic and project; E E 796, Special Topics in Electrical Engineering;

695 (E E, M E, CiE, ChE), Engineering Projects and Independent Study (with prior approval of minor chairperson); E E 757, Fundamentals of Communications; E E 782, Control Systems; M E 703, Heat Transfer; M E 707, Analytical Fluid Dynamics; M E 726, Experimental Mechanics; M E 727, Advanced Mechanics of Solids; ChE 601, Fluid Mechanics and Unit Operations; ChE 602, Heat Transfer and Unit Operations; ChE 605, Mass Transfer and Stagewise Operations; ChE 752, Process Dynamics and Control; ChE 696, Independent Study.

**Science Electives:** Zool 507-508, Human Anatomy and Physiology (or Zool 518, 527); Chem 651-652, Organic Chemistry (prerequisite: Chem 404 or 405); Bchm 656, Physiological Chemistry and Nutrition; PhEd 606, Neurology; PhEd 620, Physiology of Exercise; PhEd 652, Kinesiology.

Students interested in a career in biomedical systems and instrumentation should select Zool 507-508, Human Anatomy and Physiology, early in their curriculum.

#### Oceanography

The minor in oceanography, available to all students in the University, consists of 20 semester hours with grades of C (2.00) or better and no pass/fail courses. No more than eight major requirement credits may be used. Students may not elect minors in both ocean engineering and oceanography. All courses in the program shall be selected by students in consultation with the oceanography minor adviser in the Department of Earth Sciences.

**Required courses include:** 1) ESci 501, Introduction to Oceanography; 2) two of the following courses: ESci 752, Chemical Oceanography; ESci 758, Introduction to Physical Oceanography; ESci 759, Geological Oceanography; 3) any two of the following courses, or a suitable substitute approved by the minor adviser (it is advisable that at least one of the courses be in the biological sciences): Bot 525, 722, 723; engineering: Tech 610, ChE 695, CiE 695; E E 695, M E 695, 737, 751, 757; Micr 707, 708; Zool 674, 715, 724, 772.

Students are encouraged to declare their intention to enter the program before the end of the junior year. During the final term, students should apply to the dean to have the minor shown on the transcript.

#### Environmental Engineering Minor

The environmental engineering minor provides a comprehensive introduction to major areas of interest in environmental protection, namely air pollution and water pollution, through the three required courses. Further breadth in environmental engineering or depth in specific areas can be attained through the proper choice of elective courses.

The requirements for the minor include a total of at least 20 credits from the following: 1) three required courses: ChE 609, Fundamentals of Air Pollution and Its Control; CiE 643, Introduction to Environmental Pollution Control; ChE 772, Physiochemical Processes for Water and Air Quality Control; or CiE 644, Water and Wastewater Engineering; 2) a minimum of two elective courses from the following list: ChE 605, Mass Transfer and Stagewise Operations; ChE 772, Physiochemical Processes for Water and Air Quality Control; CiE 644, Water and Wastewater Engineering; CiE 743, Environmental Sampling and Analysis; CiE 746, Wastewater Treatment Plant Design; CiE 748, Solid Waste Disposal; CiE 749, Chemistry of Natural Waters; E E 745, Fundamentals of Acoustics; E E 762, Illumination; M E 503, Thermodynamics I; Micr 501, Public Health Microbiology; 695, Engineering Projects (ChE, CiE, E E, M E).

Choice of elective courses should be made in consultation with the adviser. Students normally start this program in the junior year and should declare their intention to enter the program as early as possible during the sophomore year. During the final term, students should apply to the dean to have the minor shown on the transcript.

### Other Programs

#### Independent Study and Projects

All departments within the college offer courses in independent study or in projects, the content varying with the current scientific and technological needs and with student and faculty interest.

Permission of the instructor and/or the department chairperson is required. (See the course descriptions for the

independent study and project courses and for specific requirements.) The initiative for independent study courses in any area rests with the student.

**Special Provisions**

"The requirement of a given course in any prescribed curriculum may be waived by the faculty of a student's college. The student's petition must be approved by his/her major adviser and the dean of the college. This power will usually be delegated by the faculty to the dean or to a committee." (Senate Rule 05.21(s): Waiver of Requirements in a Prescribed Curriculum)

This rule offers students the opportunity to develop a somewhat individualized plan of study with intellectual incentives and opportunities in addition to those in a regular curriculum.

In addition, upon the recommendation of the department chairperson, superior students may be allowed to count credits from up to two 800-level courses toward both a bachelor's degree and a master's degree, provided that the students have been admitted to the master's program.

**Research Opportunities**

The talents and expertise of the faculty in all departments are reflected in the number of ongoing research projects. Undergraduates are included in many of these research projects, with the intent of discovering and fostering their creative talents. In funded research projects, students may have an opportunity to receive pay while learning.

Some flavor of the multiplicity of the research programs is reflected in special facilities, a few of which are: Analog Computer Facility, Antenna Systems Laboratory, Bioelectronics Laboratory, Center for Industrial and Institutional Development (CIID), Computation Science Center, Electronics Laboratory, Engineering Design and Analysis Laboratory, Fluid Mechanics Laboratory, Materials Laboratories, Mechanics Research Laboratory, Sanitary Engineering Laboratory, Solid State Laboratory, Space Science Center, Wind Tunnel and Water Tunnel Facility, and X-Ray Laboratory.

Students have the opportunity to acquire applied experience in business and industry through the Center for Industrial and Institutional Development (CIID), which undertakes client-sponsored professional projects in management and technical areas for business and industry, and for state and local governments.

**Preparing for Teaching**

Students interested in mathematics education (elementary or secondary), chemistry and physics teaching, or earth science teaching should refer to the Preparing for Teaching section that begins on page 23 and to the appropriate department description of the requirements.

**Combined Programs of Study**

In addition to pursuing a single major, students may combine programs of study as follows:

**Minors:** See page 18 for requirements. See also Interdisciplinary Minors, page 55.

**Second Majors:** See page 17 for requirements.

**Dual-Degree Programs:** See page 17 for requirements.

**Student-Designed Majors:** See page 92 for requirements.

Other combined and interdisciplinary opportunities are described in "Special University Programs," page 91.

## Chemical Engineering

**Stephen S.T. Fan, Chairperson**

Chemical engineering is concerned with the analysis and design of processes that deal with the transfer and transformation of energy and material.

The practice of chemical engineering includes the conception, development, design, and application of physicochemical processes and their products; the economic development, design, construction, operation, control, and management of plants for these processes; and activities relating to public service, education, and research.

Traditional employment areas in the chemical process industries include industrial chemicals, petroleum and petrochemicals, plastics, pharmaceuticals, metals, textiles, and food. Chemical engineers are also working in increasing numbers in the emerging areas of energy engineering, pollution abatement, and biochemical and biomedical engineering; in addition, they are employed by many of the government laboratories and agencies and by private industries and institutions.

The curriculum is designed to provide training for students to enter the diverse areas of employment or graduate study. The considerable number of electives in the curriculum provides flexibility for individuals to design programs that fulfill individual needs and interests. They also provide an opportunity for students to elect departmental options or interdisciplinary minors in their programs.

A minimum of 131 credits is required for graduation with the degree of Bachelor of Science in Chemical Engineering. There are 11 electives in the chemical engineering curriculum in addition to the technical elective. Six of these are for the arts, humanities, and social science requirements, and one must be chosen from the biological sciences. Among the remaining four electives, two must be chosen from chemical engineering courses.

| **Freshman Year** | | **Fall** | **Spring** |
|---|---|---|---|
| Engl 401 | Freshman English | 4 | |
| Math 425-426 | Calculus I and II | 4 | 4 |
| Phys 407-408 | General Physics I and II | 4 | 4 |
| Chem 405 | Introductory Chemistry | 4 | |
| ChE 410 | Survey of Current Energy and Pollution Issues | | 4 |
| Elective | | | 4 |
| | | 16 | 16 |
| **Sophomore Year** | | | |
| Chem 683-684 | Physical Chemistry I and II | 3 | 3 |
| Chem 685-686 | Physical Chemistry Laboratory | 2 | 2 |
| Math 527 | Differential Equations with Linear Algebra | 4 | |
| C S 403 | Introduction to Digital Computer Programming | 2 | |
| ChE 501-502 | Introduction to Chemical Engineering I and II | 3 | 3 |
| Electives (3) | | 4 | 8 |
| | | 18 | 16 |
| **Junior Year** | | | |
| Chem 545 | Organic Chemistry | 3 | |
| Chem 546 | Organic Chemistry Laboratory | 2 | |
| ChE 601 | Fluid Mechanics and Unit Operations | 4 | |
| ChE 602 | Heat Transfer and Unit Operations | | 4 |
| ChE 603 | Applied Mathematics for Chemical Engineers | 4 | |
| ChE 604 | Chemical Engineering Thermodynamics | | 4 |
| Electives (2) | | 4 | 4 |
| Tech. Elective | | | 4 |
| | | 17 | 16 |
| **Senior Year** | | | |
| ChE 605 | Mass Transfer and Stagewise Operations | 4 | |
| ChE 606 | Chemical Engineering Kinetics | 4 | |
| ChE 608 | Chemical Engineering Design | | 4 |
| Electives (5) | | 8 | 12 |
| | | 16 | 16 |

## Options

The department offers two options in the areas of energy and environmental engineering. Students interested in one of these options should declare their intention during the sophomore year to the department faculty.

### Energy Option

This option covers the major areas of current interest in the energy field. The required courses provide students with a general background knowledge of fossil fuels, nuclear power, solar energy, and other alternative energy resources. The elective courses will permit the student to study topics of special interest in more depth or gain a broader perspective on energy and some closely related subjects. Three courses are required and a minimum of two additional courses of at least three credits each should be selected from the electives list.

**Required Courses**

| | | |
|---|---|---|
| ChE 705 | Natural and Synthetic Fossil Fuels | 4 |
| ChE 712 | Introduction to Nuclear Engineering | 4 |
| M E 710 | Solar Heating Systems | 3 |
| | | 11 |

**Elective Courses**

| | | |
|---|---|---|
| ChE 695 | Chemical Engineering Project | 3-4 |
| ChE 696 | Independent Study | 3-4 |
| ChE 772 | Physicochemical Processes for Air and Water Quality Control | 4 |
| M E 504 | Thermodynamics II | 4 |
| | | 6-8 |

**Environmental Engineering Option**

The chemical engineering program, with its substantial requirement in chemistry, fluid dynamics, heat transfer, mass transfer, unit operations, and reaction kinetics, provides students with a unique preparation to deal with many aspects of environmental pollution problems. The option gives students a special focus on the application of chemical engineering principles and processes to the solution of problems such as air pollution, water pollution, and the disposal of solid waste. Three required courses must be selected, plus two electives from the electives list. Each course must carry a minimum of three credits.

**Required Courses**

| | | |
|---|---|---|
| ChE 609 | Fundamentals of Air Pollution and Its Control | 4 |
| ChE 772 | Physicochemical Processes for Water and Air Quality Control | 4 |
| CiE 748 | Solid Waste Disposal | 3 |
| | | 11 |

**Elective Courses**

| | | |
|---|---|---|
| ChE 695 | Chemical Engineering Project | 3-4 |
| ChE 696 | Independent Study | 3-4 |
| CiE 746 | Wastewater Treatment Plant Design | 3 |
| CiE 749 | Chemistry of Natural Waters | 3 |
| | | 6-8 |

# Chemistry

**C. L. Grant, Chairperson**

Students interested in chemistry may major in one of four programs offered in the department, depending upon their plans for a career. Since the required chemistry courses in each degree program are the same in the first year, it is easy to change from one program to another, or even to another major.

In each of the programs, students should register for the following courses in the first year: Chem 405 (first semester), Introductory Chemistry; Chem 406 (second semester), Quantitative Analysis; Math 425 (first semester), Calculus I; and Math 426 (second semester), Calculus II.

## Bachelor of Science in Chemistry

This curriculum is intended to prepare students for careers as professional chemists and to provide a strong foundation for graduate study in chemistry or in interdisciplinary areas of science calling for a strong background in chemistry. The curriculum requires a greater depth in chemistry and physics than do the other degree programs.

**Requirements**

**1.** Satisfy General Education Requirements.

**2.** Language requirement: Much of the chemical literature is in German or Russian and has not been translated. Students must demonstrate a proficiency in one of these languages by completing a year's course in that language. The choice is up to the individual.

**3.** For specific course requirements, see the accompanying chart.

## Bachelor of Arts, Chemistry Major

This curriculum offers students the opportunity to combine a chemistry major with other interests. There are fewer required courses in chemistry and physics, and students have more opportunity to elect courses in other areas according to individual interests. The pre-healing arts students interested in chemistry, those preparing for secondary school teaching, or those interested in business can combine these interests with chemistry in this curriculum.

**Requirements**

1. Satisfy General Education Requirements.
2. Satisfy the Bachelor of Arts degree (see page 16).
3. For specific course requirements, see the accompanying chart.

### Bachelor of Arts, Science Major, Chemistry Concentration

This curriculum is for students interested in chemistry but wishing a broader exposure to other disciplines than can be obtained in a chemistry major. Students interested in interdisciplinary science or in chemistry as a cultural subject can satisfy their interests in this degree program, which is not intended to prepare professional chemists but, rather, is the basis for a broad liberal education.

### Chemistry Department Baccalaureate Degree Requirements

| Course | | B.S. Degree | B.A., Chemistry Major | B.A., Science Major |
|---|---|---|---|---|
| 405 | Introductory Chemistry* | x | x | x |
| 406 & 407, or 517 & 518 | Quantitative Analysis | x | x | x |
| 547 & 549, or 651 & 653 | Organic Chemistry | x | x | |
| 548 & 550, or 652 & 654 | Organic Chemistry | x | x | |
| 683 & 685 | Physical Chemistry I | x | x | |
| 684 & 686 | Physical Chemistry II | x | x | |
| 762 & 763 | Instrumental Methods of Chemical Analysis | x | x | four other chemistry courses chosen from these, except 697 and 698 |
| 697 | Chemical Literature | x | | |
| 698 | Seminar | x | | |
| 699 | Senior Thesis | x | two other chemistry courses chosen from these, except 697 and 698 | |
| 755 & 756 | Advanced Organic Chemistry | x | | |
| 774 & 775 | Inorganic Chemistry | x | | |
| 776 | Physical Chemistry III | x | | |
| 663 | Introductory Radiochemical Techniques | | | |
| 708 | Research Techniques | | | |
| 778 | Chemistry of Large Molecules | | | |
| **Other Requirements** | | | | |
| *All majors:* Math 425 and 426, Calculus I and II. | | *B.S. degree:* Phys 407-408, General Physics I and II; Germ 401-402 or 403-404, or Russ 401-402; C S 403 or 410, Introduction to Computer Programming; two chemistry-related courses (only one of which may be a chemistry course).** | *B.A. degree:* chemistry major: Phys 407, General Physics I, or Phys 401-402, Introduction to Physics I and II, or Phys 403-404, Introductory Physics for Biologists. | *B.A. degree:* science major: three approved courses in mathematics or science to complete major requirement; and two other science or mathematics courses to complete University science requirement. |

*Chem 403-404 may be substituted for Chem 405, but this is not recommended.
**Suggested courses: Math 527 or 528; Phys 505; E E 620; Bchm 601; Inco 650.

**Requirements**

**1.** Satisfy General Education Requirements.

**2.** Satisfy the Bachelor of Arts degree requirements (see page 16).

**3.** For specific course requirements, see the accompanying chart.

### Bachelor of Arts, Chemistry and Physics Teaching

This major is designed for students who wish to teach chemistry and physics in secondary schools. The number of positions available for teaching only chemistry or physics is limited, and there are more opportunities to teach both subjects on the secondary-school level. Chemistry and physics teaching majors will have good preparation for teaching these subjects and will have the necessary mathematics and education background.

**Requirements**

**1.** Satisfy General Education Requirements.

**2.** Satisfy the Bachelor of Arts degree requirements (see page 16).

**3.** Chemistry requirements: 405, Introductory Chemistry or 403-404, General Chemistry; 406, 407, Quantitative Analysis; 545, 546 or 547-548 and 549-550, Organic Chemistry; 683-684 and 685-686, Physical Chemistry I and II.

**4.** Physics requirements: 407, General Physics I; 408, General Physics II; 505, General Physics III; 605, Experimental Physics I; and Physics 406, Introduction to Modern Astronomy, strongly recommended.

**5.** Math requirements: 425, Calculus I, and 426, Calculus II.

**6.** All education courses in the teacher preparation program (see pages 23-25).

## Civil Engineering

**Paul L. Bishop, Chairperson**

Civil engineers are concerned with planning, design, and construction of public and private facilities, including those for: transportation, control, purification, and distribution of water; collection and treatment of waste products; and residential and industrial purposes. Facilities must not only provide safe, efficient service to the users but must, in addition, be compatible with the environment (both natural and human) in which they are placed. Since many of the clients are governmental agencies, civil engineers must secure approval of the citizens involved or their elected representatives.

The program leads to a Bachelor of Science degree in civil engineering. The strong analytical basis of the program prepares graduates for many career opportunities. They may enter professional practice or pursue further study in graduate school. Undergraduates study the basic sciences and mathematics, as well as engineering science, analysis, and design.

| Freshman Year | | Fall | Spring |
|---|---|---|---|
| Math 425 and 426 | Calculus I and II | 4 | 4 |
| Chem 403, 404 | General Chemistry | 4 | 4 |
| Engl 401 | Freshman English | 4 | |
| Phys 407 | General Physics I | | 4 |
| Electives (2) | Group II | 4 | 4 |
| | | 16 | 16 |
| **Sophomore Year** | | | |
| CiE 525-526 | Mechanics, I, II | 3 | 3 |
| CiE 527 | Mechanics III | | 3 |
| CiE 505 | Surveying | | 4 |
| Phys 408 | General Physics II | 4 | |
| Math 527 | Differential Equations with Linear Algebra | 4 | |
| Math 528, 644, or 645 | | 4 | |
| C S 410 | Introduction to Computer Programming | 4 | |
| Electives (2) | Group II | 4 | 4 |
| | | 19 | 18 |
| **Junior Year** | | | |
| CiE 622 | Engineering Materials | 4 | |
| CiE 642 | Fluid Mechanics | 4 | |
| CiE 643 | Introduction to Environmental Pollution Control | 3 | |
| CiE 681 | Structural Analysis | 4 | |
| CiE 623 | Systems Analysis | | 3 |
| CiE 644 | Water and Wastewater Engineering | | 3 |
| CiE 665 | Soil Mechanics | | 4 |
| CiE 682 | Structural Design Concepts | | 4 |
| Elective (1) | Group II | | 4 |
| | | 15 | 18 |

**Senior Year**

| | | | |
|---|---|---|---|
| Elective (1) | Group I (Biological Science) | 4 | |
| CiE Elective (5) | | 11 | 8 |
| Elective (1) | Group II | | 4 |
| Elective (1) | Any department except CiE | | 4 |
| | | 15 | 16 |

The electives will be chosen to meet requirements of the University, the department, and any option selected. A minimum of 133 total credits is required for graduation.

Civil engineering students must obtain a 2.00 grade-point average in CiE courses as a requirement for graduation.

## Options

Students may select an option in environmental engineering or constructed systems. The option is selected at the beginning of second semester in the junior year. The options must meet all the previously listed graduation requirements.

### Environmental Engineering Option

**Dennis J. O'Brien, Adviser**

Environmental engineering is the application of engineering principles and practices to one or more elements of the environment to protect or improve the quality of life. Environmental engineers use specialized engineering knowledge to systematically manage water, air, and land resources. This option provides fundamental environmental engineering concepts and methods of design and allows specialization in an area of the student's choice.

Four courses (12 credits) are required. At least 8 credits must be selected from the following list, of which a minimum of 4 must be in civil engineering. Courses not on the list may be elected upon approval of the student's adviser.

**Required Courses**

| | | |
|---|---|---|
| Micr 503 | General Microbiology | 4 |
| CiE 743 | Environmental Sampling and Analysis | 2 |
| CiE 746 | Wastewater Treatment Plant Design | 3 |
| CiE 749 | Chemistry of Natural Waters | 3 |
| | | 12 |

**Elective Courses**

| | | |
|---|---|---|
| ChE 712 | Introduction to Nuclear Engineering | 4 |
| CiE 740 | Rural Wastewater Engineering | 3 |
| CiE 741 | Open Channel Flow | 3 |
| CiE 745 | Hydrology and Hydraulics | 3 |
| CiE 748 | Solid Waste Disposal | 3 |
| CiE 794 | Reinforced Concrete Design | 4 |
| Chem 545 | Organic Chemistry (plus laboratory) | 5 |
| Chem 683 | Physical Chemistry I | 3 |
| ChE 609 | Fundamentals of Air Pollution and Its Control | 4 |
| INER 709 | Soils and Community Planning | 2 |
| Hydr 710 | Groundwater Hydrology | 4 |

### Constructed Systems Option

**L. H. Klotz, Adviser**

All structures, regardless of purpose, must be planned, designed, and built to resist the natural forces (gravity, wind, earthquake) and those imposed by people during construction and use of the structure.

Two courses (8 credits) are required. A minimum of 15 credits must be elected from the following list, of which 11 must be in civil engineering; courses not on the list may be elected upon approval of the student's adviser.

**Required Courses** (2)

| | | |
|---|---|---|
| CiE 685 | Indeterminate Structures | 4 |
| CiE 793 or 794 | Structural Design in Steel or Reinforced Concrete Design | 4 |

**Electives** (4)

Minimum of 11 credits from the following:

| | | |
|---|---|---|
| CiE 763 | Advanced Soil Mechanics I | 4 |
| CiE 765 | Foundation Engineering | 4 |
| CiE 782 | Timber Design | 2 |
| CiE 784 | Structural Analysis by Matrix and Numerical Method | 4 |
| CiE 785 | Introduction to Structural Dynamics | 3 |
| CiE 790 | Inelastic Structural Design | 4 |
| CiE 793 or 794 | Structural Design in Steel or Reinforced Concrete Design | 4 |

| Minimum of 4 credits from the following: | | |
|---|---|---|
| Arts 455 | Architectural Drafting and Design | 4 |
| ESci 401 or 402 | Principles of Geology I or II | 4 |
| Math or C S | (any 600 course or above) | 4 |
| M E 441 | Engineering Graphics | 4 |
| M E 727 | Advanced Mechanics of Solids | 4 |
| Hydr 603 | Hydrology and Water Management | 4 |

## Earth Sciences

**Herbert Tischler, Chairperson**

The courses offered in the Department of Earth Sciences cover the broad spectrum of geology and oceanography. They encompass a group of related studies concerned with an understanding of the size, shape, and constitution of the earth; the processes that are now, or have formerly been, at work upon its surface, in its oceans, and within its interior; its origin; and evolution of life upon it.

The need for people trained in the earth sciences has been emphasized by the search for new and additional energy sources and essential mineral resources, by the increased concern with intelligent management of the environment, and by expansion of research in both oceanography and extraterrestrial geology. In addition, the demand for well-trained secondary teachers of earth sciences has steadily increased over the past few years.

Four undergraduate degree programs are offered through the Department of Earth Sciences.

### Bachelor of Science in Geology

This program represents the strongest concentration in the earth and cognate sciences and is especially well suited for students who plan to continue their studies in graduate school. Beyond a central core of courses, there is sufficient flexibility in course selection so that students may, in consultation with their academic advisers, orient the program toward a particular facet of the earth sciences (e.g., mineralogy-petrology, oceanography, geomorphology, paleontology-stratigraphy, etc.).

#### Requirements

**1.** Satisfy the General Education Requirements.

**2.** Satisfactorily complete Math 425 and 426, Chem 403-404, and Phys 407-408.

**3.** Complete a minimum of 12 courses in earth sciences, which should include: ESci 401-402, Principles of Geology; ESci 501, Introduction to Oceanography; ESci 512, Descriptive and Determinative Mineralogy; ESci 531, Structural Geology; ESci 561, Geomorphology; ESci 614, Petrography; ESci 652, Invertebrate Paleontology; ESci 754, Sedimentation-Stratigraphy; and three approved earth sciences electives.

**4.** Complete Mathematics 527 and 528 or approved electives.

**5.** Complete two additional approved electives.

### Bachelor of Arts, Geology Major

This program offers students an opportunity to obtain a broad liberal education and a general background in geology with a greater degree of freedom in choosing electives than in the Bachelor of Science program. By a careful choice of electives, students can prepare for graduate school, business, or industry.

#### Requirements

**1.** Satisfy the General Education Requirements.

**2.** Satisfy the Bachelor of Arts degree requirements (page 16).

**3.** Complete a minimum of eight courses in the department with a C- (1.67) or better, which should include: ESci 401-402, Principles of Geology; ESci 512, Descriptive and Determinative Mineralogy; and five upper-level earth sciences courses, two of which must be chosen from courses numbered 700 or above.

**4.** Math requirements: 425, Calculus I, and 426, Calculus II.

It is strongly advised that students complete, as early as possible, a year each of college chemistry and physics.

It is also suggested that students include Hist 521-522, History of Science, in their program.

### Bachelor of Arts, Science Major, Earth Sciences Concentration

This program is for the student who wants a liberal education with a scientific slant to it. It is not designed to produce professional scientists but rather combines the liberal arts with a reasonable exposure to science in general and to earth sciences in particular.

**Requirements**

**1.** Satisfy the General Education Requirements.

**2.** Satisfy the Bachelor of Arts degree requirements (page 16).

**3.** Complete: ESci 401-402, Principles of Geology; ESci 501, Introduction to Oceanography; and three approved earth sciences electives.

**4.** Math requirements: 425, Calculus I, and 426, Calculus II.

**5.** Additional major requirements: three approved courses in science over and above those used to satisfy University General Education Requirements.

### Bachelor of Arts, Earth Science Teaching Major

This program is specifically designed to prepare students to teach earth sciences in secondary school. Upon graduation from this program, students receive a full teacher certification which is recognized in most states.

**Requirements**

**1.** Satisfy the General Education Requirements.

**2.** Satisfy the Bachelor of Arts degree requirements (page 16).

**3.** Complete: ESci 401-402, Principles of Geology; ESci 501, Introduction to Oceanography; Geog 473, The Weather; Chem 401-402, General Chemistry; Phys 401-402, Introduction to Physics I and II (or Phys 403-404); Phys 406, Introduction to Modern Astronomy; plus 12 approved elective credits from intermediate and/or advanced earth sciences courses.

**4.** Math requirements: 425, Calculus I, and 426, Calculus II.

**5.** Satisfy the secondary-school teacher education program. (See "Preparing for Teaching," page 23.)

## Electrical and Computer Engineering

**Ronald R. Clark, Chairperson**

Electrical engineers are designing systems for investigating the ocean, for monitoring medical procedures, and for processing information from outer space. They develop electronic instrumentation for environmental protection, design mini- and microcomputers for industry, and use their knowledge to help solve such major problems of society as transportation, pollution, and health care delivery.

At UNH, the keynote of the electrical and computer engineering program is the involvement of students in the solution of real-world problems. During the freshman and sophomore years, students take basic courses in mathematics and physics, learn how to use the computer, and receive introductory experience in electric circuits, logic design, and electronics.

The electrical and computer engineering curriculum prepares students for graduate work in electrical engineering, for productive employment as electrical engineers, and for graduate work in related areas such as business administration. It is compatible with the dual-degree program described on page 17.

Electrical engineering students must obtain a 2.00 grade-point average in E E courses as a requirement for graduation.

### Basic Curriculum for Bachelor of Science in Electrical Engineering

Students, with their advisers' assistance, should plan their programs based on the following distribution of courses for a total of 133 cr.:

**First Two Years Common to All Options**

| **Freshman Year** | | **Fall** | **Spring** |
|---|---|---|---|
| *Core Courses* | | | |
| Math 425 and 426 | Calculus I and II | 4 | 4 |
| Engl 401 | Freshman English | | 4 |
| Elective | Life science elective | 4 | |
| C S 410 | Introduction to Computer Programming | | 4 |
| Phys 407 | General Physics I | | 4 |
| Electives (2) | Group II | 8 | |
| | | 16 | 16 |

| **Sophomore Year** | | | |
|---|---|---|---|
| *Core Courses* | | | |
| Math 527 | Differential Equations with Linear Algebra | 4 | |
| E E 544 | Signal Processing Fundamentals | | 3 |
| Phys 408, 505 | General Physics II and III | 4 | 4 |
| E E 541 | Electrical Circuits I | 4 | |
| E E 543 | Introduction to Digital Systems | 4 | |

| | | | |
|---|---|---|---|
| E E 548 | Basic Electronic and Electromechanical Circuits | | 4 |
| M E 525 | Mechanics I | | 3 |
| Elective (1) | Group II | | 4 |
| | | 16 | 18 |
| **Junior Year** | | | |
| *Core Courses* | | | |
| E E 545 | Electrical Networks | 3 | |
| E E 551-552 | Advanced Electronics II and III | 3 | 3 |
| E E 603 | Electromagnetic Fields and Waves I | 3 | |
| E E 517-518 | Junior Laboratory I and II | 1 | 3 |
| M E 505 | Introduction to Thermodynamics and Heat Transfer | | 3 |
| Electives (2) | Group II | 4 | 4 |
| | Subtotal | 14 | 13 |
| *Computer Engineering Option* | | | |
| E E 714 | Minicomputer Applications Engineering | 4 | |
| E E 712 | Logical Design of Digital Computers | | 4 |
| | Total | 18 | 17 |
| *Electrical Engineering Systems Option* | | | |
| E E 714 | Minicomputer Applications Engineering | 4 | |
| E E 656 | Electromechanical Devices | | 4 |
| | Total | 18 | 17 |
| *Electrical Engineering Science Option* | | | |
| Elective | Math elective | 4 | |
| E E 604 | Electromagnetic Fields and Waves II | | 4 |
| | Total | 18 | 17 |
| **Senior Year** | | | |
| *Core Courses* | | | |
| Elective (1) | Group II | 4 | |
| Electives (2) | Non-E E electives | 4 | 4 |
| | Subtotal | 8 | 4 |
| *Computer Engineering Option* | | | |
| C S 710 | Advanced Programming Systems | | 4 |
| E E 695 or 711, or C S 611,612, 711 or Math 753 | | 4 or | 4 |
| E E 757 or 782 | | 4 or | 4 |
| Electives | Approved professional electives | 4 | 4 |
| | Total | 16 | 16 |
| *Electrical Engineering Systems Option* | | | |
| E E 757 | Fundamentals of Communications | 4 | |
| E E 782 | Control Systems | | 4 |
| Electives | Approved professional electives | 4 | 8 |
| | Total | 16 | 16 |
| *Electrical Engineering Science Option* | | | |
| E E 757 or 782 | | 4 or | 4 |
| E E 762 or 745 | | 4 or | 4 |
| E E 605 | Electronic Properties of Materials and Devices | | 4 |
| Electives | Approved professional electives | 4 | 4 |
| | Total | 16 | 16 |

**Note:** Students who have not had a year of high school chemistry with a grade of B or better are required to take Chem 403 sometime during their college program. For those students, 137 credits are required for graduation.

## Options and Minors

In the junior year, students complete the core courses and begin studying in a chosen option. Students must choose one of the three options and additionally may elect one of the various minors (see page 55 and 56 for descriptions of minors). The options, which are described in the following paragraphs, provide for professional electives so that individual student interests may be pursued. In addition, the senior year features many opportunities for individual or group projects. Each option is made up of seven courses.

### Computer Engineering Option

During the past several years, advances in the technology of electronic circuit manufacture have vastly reduced the costs of digital computers. This low cost, coupled with flexibility, has allowed them to be used in a broad variety of applications, from data processing in a small retail store

to controlling a machine tool in a manufacturing plant. Since computers are basically electronic devices, it is primarily the job of electrical engineers to design or specify the purchase of the computer and integrate it into larger systems. To do so requires a knowledge of both hardware (circuits) and software (programming) concepts. In this option, students will learn to design, build, and test systems involving digital computers.

**Required Courses** E E 712, E E 714, C S 710.

**Elective Courses** E E 757 or E E 782; E E 695 or E E 711, or C S 611, C S 612, C S 711, or Math 753; and two approved professional electives chosen in consultation with the adviser to meet students' professional objectives.

**Electrical Engineering Systems Option**

The electrical engineering systems option provides students with the fundamentals of communication, control, and computer systems. An effort is made to balance both the theory and the applications so that students will appreciate both system development and system implementation. In addition to the four required courses, there are three additional professional elective courses that allow students to delve further into areas of interest.

**Required Courses** E E 656, E E 714, E E 757, and E E 782.

**Elective Courses** Three courses chosen in consultation with the adviser to satisfy students' and programmatic goals.

**Electrical Engineering Science Option**

The electrical engineering science option is designed for those students who do not wish to limit themselves to one area of specialization. It permits students to sample a variety of professional areas while also allowing a stronger base of classical electrical engineering skills. Several additional electrical science courses are required, while additional elective courses may be selected from communications, controls, computer systems, biomedical and ocean instrumentation, mathematics, and other professional areas.

**Required Courses** E E 604, E E 605.

**Elective Courses** E E 757 or E E 782; E E 762 or E E 745; one course in mathematics and two additional professional electives chosen in consultation with the adviser to meet students' professional objectives.

## Engineering Technology

**Donald W. Melvin, Director**

Engineering technology is the part of the engineering field that requires the application of engineering and scientific knowledge and methods combined with technical skills in support of engineering activities. Normally engineering technology is not concerned with the development of new principles and methods. The Engineering Technology Program offers only junior- and senior-level work. Students admitted to this program must have an appropriate associate degree from the New Hampshire Technical Institute, the Vermont Technical College, or an equivalent school.

Curricula in electrical engineering technology and mechanical engineering technology are offered. Students may continue study in their field of specialization, select electives which broaden their educational background, and participate in project courses where, as part of a technology team, their talents are applied in solving real problems.

**Electrical Engineering Technology**

| **Junior Year** | | **Fall** | **Spring** |
|---|---|---|---|
| E T 671 | Industrial Electronics | | 4 |
| E T 677 | Integrated Electronics | | 4 |
| E T 637 | Heat and Fluid Power I | 4 | |
| E T 674 | Control Systems and Components | 4 | |
| E T 680 | Communications and Fields | 4 | |
| C S 410 | Introduction to Computer Programming | | 4 |
| Electives (1) | | 4 | 4 |
| **Senior Year** | | | |
| E T 691 | Electrical Engineering Technology Project | 4 | 4 |
| E T 633 | Industrial Organization and Law | 4 | |
| E T 634 | Economics of Business Activities | | 4 |

| | | | |
|---|---|---|---|
| E T 690 | Digital Systems and Microprocessors | 4 | |
| Electives (3) | | 4 | 8 |
| | | 16 | 16 |

**Mechanical Engineering Technology**

| **Junior Year** | | **Fall** | **Spring** |
|---|---|---|---|
| E T 637 and 638 | Heat and Fluid Power I and II | 4 | 4 |
| E T 641 | Production Systems | 4 | |
| E T 675 and 676 | Electrical Technology I and II | 4 | 4 |
| E T 644 | MET Concepts in Design and Analysis | | 4 |
| Electives (2) | | 4 | 4 |
| | | 16 | 16 |
| **Senior Year** | | | |
| E T 651 | Mechanical Engineering Technology Project | 4 | 4 |
| E T 633 | Industrial Organization and Law | 4 | |
| E T 634 | Economics of Business Activities | | 4 |
| E T 695 | Independent Study | 4 | |
| Electives (3) | | 4 | 8 |
| | | 16 | 16 |

## Mathematics and Computer Science

**M. E. Munroe, Chairperson**

Seven undergraduate programs are offered through the Department of Mathematics and Computer Science. Normally, students will enter one of these specific programs; however, they may change programs at any time. Students who take C S 410 and Math 425 and 426 in the freshman year are on schedule in any of the seven programs in the department. The normal sophomore courses are Math 527, 528, and 531. This sequence meets all major requirements at the sophomore level in five of the seven programs. The B.S. in mathematics education (elementary option) has a completely different sophomore program, while the B.S. in computer science requires Math 527 and C S 611 and 612 in the sophomore year.

In some programs, there are courses outside the department that should be completed in the sophomore year. These are noted in the detailed lists of requirements that follow.

A major in the department may not use departmental courses to satisfy Group I General Education Requirements. However, a student in the Bachelor of Science in Computer Science program may use in Group III any mathematics course not used to satisfy major requirements, and a student in any other program in the department may use in Group III any computer science course not used to satisfy major requirements.

### Bachelor of Science in Mathematics

This program represents the strongest concentration in mathematics of any program offered by the department. Included among the required courses are those usually required for admission to graduate work in mathematics. Through a judicious choice of electives, students may construct a stronger pregraduate program, or they may slant the program toward a career in business or industry.

**Requirements**

**1.** General Education Requirements must be satisfied, and Phys 407-408 must be included among the science courses.

**2.** Language requirement: Students must demonstrate proficiency in one of the three languages: French, German, or Russian. (See B.A. requirements, page 16.)

**3.** Departmental requirements: C S 410, Introduction to Computer Programming; Math 425, Calculus I; Math 426, Calculus II; Math 527, Differential Equations with Linear Algebra; Math 528, Multidimensional Calculus; Math 531, Introduction to Abstract Mathematics; Math 761, Abstract Algebra; Math 762, Linear Algebra; Math 767, One-dimensional Real Analysis; Math 784, Topology; Math 788, Complex Analysis; and three approved mathematics or computer science electives.

### Bachelor of Arts, Mathematics Major

This program offers a broader liberal education than do any of the Bachelor of Science programs. By a careful

choice of electives, however, students can shape this major into a preparation for graduate school, business, or industry.

**Requirements**

**1.** Satisfy General Education Requirements.

**2.** Satisfy Bachelor of Arts degree requirements (page 16).

**3.** Departmental requirements: Math 425, Calculus I; Math 426, Calculus II; Math 527, Differential Equations with Linear Algebra; Math 528, Multidimensional Calculus; Math 531, Introduction to Abstract Mathematics; Math 761, Abstract Algebra; Math 762, Linear Algebra; Math 767, One-dimensional Real Analysis; and three approved mathematics or computer science electives.

### Bachelor of Arts, Science Major, Mathematics Concentration

This program is for students who want a liberal education with a scientific slant to it. It is not designed to produce professional scientists but, rather, combines the liberal arts with a reasonable exposure to science in general and mathematics in particular.

**Requirements**

**1.** Satisfy General Education Requirements.

**2.** Satisfy Bachelor of Arts degree requirements (page 16).

**3.** Departmental requirements: C S 410, Introduction to Computer Programming; Math 425, Calculus I; Math 426, Calculus II; Math 527, Differential Equations with Linear Algebra; Math 528, Multidimensional Calculus; Math 531, Introduction to Abstract Mathematics; Math 761, Abstract Algebra, or Math 767, One-dimensional Real Analysis; and one approved mathematics or computer science elective.

**4.** Additional major requirements: three approved courses in science over and above those used to satisfy General Education Requirements.

### Bachelor of Science in Mathematics Education

This is a professional degree program to prepare students for teaching mathematics at the elementary or secondary level. The program is coordinated with the education department's five-year, teacher-certification program. Students may complete the degree requirements in four years; however, to receive full teacher certification a year-long teaching internship in the fifth year is required. (The internship can be coupled with other graduate work leading to a master's degree.) See "Preparing for Teaching," page 23.

**Requirements**

**1.** Satisfy General Education Requirements.

**2.** Education requirements: Educ 500, Exploring Teaching; Educ 700, Educational Structure and Change; Educ 701, Human Learning and Development; Educ 703, Alternative Teaching Models; Educ 705, Alternative Perspectives on the Nature of Education.

*Elementary Option*

**3.** Departmental requirements: C S 410, Introduction to Computer Programming; Math 419, Evolution of Mathematics; Math 425, Calculus I; Math 425, Calculus II; Math 621, 622, 623, Number Systems, Geometry, and Topics for Elementary School Teachers; Math 636, Probability and Statistics; Math 657, Geometry I; Math 703, Mathematics Education, K-6; Math 791, Mathematics Education; one approved mathematics or computer science elective.

**4.** Additional major requirements: Phys 406, Introduction to Modern Astronomy; Educ 706, Introduction to Reading.

*Secondary Option*

**3.** Departmental requirements: C S 410, Introduction to Computer Programming; Math 425, Calculus I; Math 426, Calculus II; Math 527, Differential Equations with Linear Algebra; Math 528, Multidimensional Calculus; Math 531, Introduction to Abstract Mathematics; Math 636, Probability and Statistics; Math 657, Geometry I; Math 698, Senior Seminar; Math 761, Abstract Algebra; Math 791, Mathematics Education; and two approved mathematics or computer science electives.

### Bachelor of Science in Computer Science

This program is designed to prepare students for employment in the computer field or to pursue graduate study in computer science. The program places principal emphasis on software system design and development but also includes a broad background in basic mathematics and an introduction to computer hardware.

**Requirements**

**1.** Satisfy General Education Requirements.

**2.** Mathematics requirements: Math 425, Calculus I; Math 426, Calculus II; Math 527, Differential Equations with Linear Algebra; Math 531, Introduction to Abstract Mathematics; Math 644, Applied Probability and Statistics; Math 753, Numerical Methods and Computers I.

**3.** Computer science requirements: C S 410, Introduction to Computer Programming; C S 611, Assembler-Language Programming; C S 612, Data Structures and Processes; C S 710, Advanced Programming Systems; C S 711, Programming Languages and Compiler Construction.

**4.** Computer engineering requirements: E E 531, Elements of Digital Systems; E E 712, Logical Design of Digital Computers.

**5.** Additional major requirements: three approved electives in mathematics, computer science, or computer engineering.

## Bachelor of Science (Interdisciplinary Programs in Mathematics and Its Applications)

These programs are designed to prepare students for employment in various areas of applied mathematics. Certain of them also lead to graduate work in appropriate fields (e.g., chemical physics, computer science, economics). In this program, the major may consist of mathematics combined with any one of the following disciplines: chemistry, computer science, economics, electrical science, fluid dynamics, mechanics, thermodynamics, and physics.

**Requirements**

**1.** Satisfy General Education Requirements.

**2.** Core requirements: C S 410, Introduction to Computer Programming; Math 425, Calculus I; Math 426, Calculus II; Math 527, Differential Equations with Linear Algebra; Math 528, Multidimensional Calculus; and Math 645, Applied Linear Algebra.

**3.** Additional mathematics requirements:

In Mathematics-Computer Science: four approved mathematics electives. Proper choice of these depends mainly on the students' career objectives. These electives should be chosen only in consultation with a faculty adviser designated by the department.

In Mathematics-Economics: Math 735, Probability; Math 736, Statistics; and two approved mathematics electives.

In all other options: Math 646, Analysis for Applications; Math 647, Complex Analysis for Applications; and two approved mathematics electives.

**4.** Requirements in other disciplines: Each interdisciplinary major consists of 10 mathematics courses (see above) plus five courses in the other discipline. Specific requirements follow. If more than five courses outside of mathematics are required or elected, the excess may be used to satisfy appropriate General Education Requirements.

**Mathematics—Chemistry Option**

Chem 405, Introductory Chemistry; Chem, 683, Physical Chemistry I, *and* Chem 685, Physical Chemistry Laboratory (these two courses regarded as a single unit); Chem 684, Physical Chemistry II, *and* Chem 686, Physical Chemistry Laboratory (these two courses regarded as a single unit); Chem 776, Physical Chemistry III; *either* Phys 701, Introduction to Quantum Mechanics I, *or* Chem 775, Inorganic Chemistry.

Note: Chem 547-548, Organic Chemistry, suggested as elective for those planning to do graduate work in chemical physics. Chem 405 should be taken no later than the sophomore year.

**Mathematics—Computer Science Option**

A total of five of the following courses, including at least one from each of the following three groups: Group 1, C S 611, Assembler-Language Programming; C S 612, Data Structure and Processes; C S 710, Advanced Programming Systems; C S 711, Programming Languages and Compiler Construction. Group 2: Math 753 and 754, Numerical Methods and Computers I and II. Group 3: E E 531, Elements of Digital Systems; E E 711, Digital Systems; E E 712, Logical Design of Digital Computers; E E 714, Minicomputer Applications Engineering.

**Mathematics—Economics Option**

Econ 401 and 402, Principles of Economics (Macro, Micro); Econ 605, Intermediate Microeconomic Analysis; Econ 611, Intermediate Macroeconomic Analysis; and any two of the following three courses: Econ 727, Econometric

Theory; Admn 705, Operations Research; Econ 737, Decision Theory and Bayesian Methods.

Note: Econ 401 and 402 should be taken no later than the sophomore year.

**Mathematics—Electrical Science Option**

E E 541-542, Electrical Circuits I and II; E E 603 and 604, Electromagnetic Fields and Waves I and II; E E 757, Fundamentals of Communications; E E 782, Control Systems.

**Mathematics—Fluid Dynamics Option**

M E 503, Thermodynamics I; M E 508, Fluid Dynamics; M E 525, Mechanics I; M E 707, Analytical Fluid Dynamics; M E 708, Gas Dynamics.

**Mathematics—Mechanics Option**

M E 503, Thermodynamics I; M E 525, 526, 527, Mechanics I, II, and III; any two of the following three courses: M E 723, Advanced Dynamics; M E 724, Vibration Theory and Applications; and M E 727, Advanced Mechanics of Solids.

**Mathematics—Thermodynamics Option**

M E 503, Thermodynamics I; M E 508, Fluid Dynamics; M E 525, Mechanics I; and any two of the following three courses: M E 701, Macroscopic Thermodynamics; M E 702, Statistical Thermodynamics; M E 703, Heat Transfer.

**Mathematics—Physics Option**

Phys 407-408, General Physics I and II; Phys 505, General Physics III; and *either* Physics 701-702, Introduction to Quantum Mechanics I and II; *or* Phys 703-704, Electricity and Magnetism I and II.

Note: Phys 407-408 should be taken no later than the sophomore year.

## Mechanical Engineering

**William Mosberg, Chairperson**

Mechanical engineering is a challenging profession encompassing research, design, development, and production of aerospace vehicles, underwater vessels, instrumentation and control systems, nuclear and conventional power plants, and consumer and industrial products in general. The profession also makes contributions through more fundamental studies of material behavior, the mechanics of solids and fluids, and energy transformation.

The curriculum in mechanical engineering is designed to prepare prospective graduates either for more advanced studies or for beginning professional engineering careers. The program of study provides a foundation in the basic physical sciences, mechanics of solids and fluids, dynamic systems, thermal sciences, materials science, and design. Flexibility in the curriculum enables students to gain competence in any of these specific areas, developing abilities in analysis, experimentation, and engineering design. The curricula include elective courses in the arts, the humanities, and the social sciences to provide a liberal education.

The program in mechanical engineering is further designed to develop the creative potential to meet increasingly complex needs of industry, government, and education, while appreciating the role of technology in a modern society.

Students, with their advisers' assistance, should plan a program based on the following distribution of courses, which average 16 credit hours per semester, and totaling not less than 128 credits.

The outline that follows is to be considered as being typical only in terms of format. Within the constraints of satisfying all of the requirements and having all necessary prerequisites, schedules may vary. Such variation will, in general, be caused by scheduling needs or student preference.

Electives should be selected in consultation with a departmental adviser from courses that will lead to a balanced program in the chosen area of interest. The free electives are entirely students' own choice. Technical elective requirements are four courses of at least three credits each.

| Freshman Year | | Fall | Spring |
|---|---|---|---|
| Engl 401 | Freshman English | 4* | |
| Chem 405** | Introductory Chemistry | | 4* |
| Math 425 and 426 | Calculus I and II | 4 | 4 |
| Phys 407-408 | General Physics I and II | 4 | 4 |
| Elective | Any approved biological science | | 4* |
| M E 441 | Engineering Graphics | 4* | |
| | | 16 | 16 |

**Sophomore Year**

| | | | |
|---|---|---|---|
| Math 527 | Differential Equations with Linear Algebra | 4 | |
| Math 528 | Multidimensional Calculus | | 4 |
| M E 525-526 | Mechanics I and II | 3 | 3 |
| E E 541-542 | Electrical Circuits I and II | 4 | 4 |
| M E 561 | Introduction to Materials Science | 3 | |
| M E 561 L | Introduction to Materials Science Laboratory | 1* | |
| M E 503 | Thermodynamics I | | 4 |
| Electives (2) | Arts and humanities or social science | 4 | 4 |
| | | 19 | 19 |

**Junior Year**

| | | | |
|---|---|---|---|
| M E 527 | Mechanics III | 3 | |
| M E 628 | Introduction to Vibrations | | 3 |
| M E 508 | Fluid Dynamics | 4 | |
| M E 703 | Heat Transfer | | 3 |
| C S 410 | Introduction to Computer Programming | 4 | |
| M E 648 | Introduction to Measurement and Experimental Methods | | 3 |
| Electives (2) | Arts and humanities or social science | 4 | 4 |
| Elective (1) | Technical elective | | 3 (4) |
| Elective (1) | "Free" elective | 3 (4) | |
| | | 18(19) | 16(17) |

**Senior Year**

| | | | |
|---|---|---|---|
| M E 771 | Dynamic Systems Modeling | 3 | |
| M E | Course to be specified | | 3 |
| Electives (3) | Technical electives | 3 (4) | 6 (8) |
| Electives (2) | Arts and humanities or social science | 4 | 4 |
| Elective (1) | "Free" elective | 3 (4) | |
| | | 13(15) | 13(15) |

*To facilitate scheduling, many students may be required to take this course in the alternate semester.

**Students whose preparation in chemistry is weak may be required to take a full year of chemistry, i.e., Chem 403-404.

**Energy Option**

Many mechanical engineering graduates traditionally pursue professional careers in areas that are related to energy generation, conversion, or use. Increased emphasis on energy conservation and the development of alternate energy sources has created challenging and rewarding opportunities for graduates having a strong interest and capability in these fields. The Department of Mechanical Engineering offers a formal energy option intended to promote the development of well-planned student programs with special emphasis on courses applicable to career goals in energy related industries. This program of five courses, open to mechanical engineering majors, emphasizes those subjects necessary for an understanding of the engineering aspects of energy systems and related problem areas. Students electing the energy option should do so during the first semester of the junior year and have their program approved by a department faculty member involved in the option. To have the energy option shown on transcripts, students should file appropriate forms with the dean's office early in the final semester.

**Required Courses**

(Minimum of four including M E 697)

| | |
|---|---|
| M E 504 | Thermodynamics II |
| M E 697 | Seminar (energy topics section) |
| M E 710 | Solar Heating Systems |
| ChE 705 | Natural and Synthetic Fossil Fuel |
| ChE 712 | Introduction to Nuclear Engineering |

**Electives** (1)

| | |
|---|---|
| M E 708 | Gas Dynamics |
| M E 695A | Undergraduate Projects and Independent Study (Thermal Science) |

## Physics

**Robert E. Houston, Jr., Chairperson**

Physics is concerned with the properties of matter and the laws that describe its behavior. It is an exact science based on precise measurement, and its objective is the kind of understanding that leads to the formulation of mathematical relationships between measured quantities. As a fundamental science, its discoveries and laws are basic to understanding in nearly all areas of science and technology. Advances in such diverse fields as diagnostic medical techniques, transistors, and air pollution have relied heavily on the application of basic physical laws and principles.

Students interested in the study of physics at the University of New Hampshire will find a strong interaction between research and academic programs. Undergraduates have participated in research studies ranging from atomic spectroscopy using laser sources to astrophysical studies of the solar system using space probes. These experiences have proven beneficial to engineering and physics students alike. The student-faculty ratio in physics is quite low so that considerable faculty contact with students is encouraged. Strong efforts are being made to utilize the remote-access computer terminals in undergraduate courses at all levels. The department has its own library, which provides a comfortable, inviting atmosphere for study and relaxed reading.

The suggested programs that follow are indicative of the flexibility available to students, whether they are preparing for graduate work in physics, industrial opportunities, governmental research, secondary-level teaching, or a general education that might utilize the fundamental knowledge of physics.

The following undergraduate degree programs are offered through the Department of Physics.

### Bachelor of Arts, Science Major, Physics Concentration

This is the most flexible degree offered by the department. It is not designed to produce a professional physicist but, rather, to provide an opportunity for interdisciplinary combinations with emphasis on physics.

**Requirements**

**1.** Satisfy General Education Requirements.

**2.** Satisfy Bachelor of Arts degree requirements (page 16).

**3.** Physics requirements: six courses approved by the department.

**4.** Math requirements: 425, Calculus I, and 426, Calculus II.

**5.** Any three approved courses in science not used to satisfy other University requirements.

### Bachelor of Arts, Physics Major

This degree provides an opportunity for a broad and liberal education, which in some cases may be sufficient for graduate work. A judicious choice of electives may also prepare students in a restricted area in physics in conjunction with other disciplines or other less technical applications in the field of physics.

**Requirements**

**1.** Satisfy General Education Requirements.

**2.** Satisfy Bachelor of Arts degree requirements (page 16).

**3.** Phys 401-402 or 407-408; 505. Note that Math 425 and 426 are prerequisites for some of the courses.

**4.** Five additional courses in physics approved by the department, three of which must be at the 500 level or above.

**5.** Math requirements: 425, Calculus I, and 426, Calculus II.

### Bachelor of Arts, Chemistry and Physics Teaching

For information see page 61.

### Bachelor of Science in Physics

This degree is the professional program offered by the department. The required courses are those necessary for admission to graduate work or a career in industry. Additional courses may be beneficial for graduate preparation or may be desirable for more depth in certain areas of physics. Students are strongly advised to demonstrate proficiency in French, German, or Russian.

**Requirements**

**1.** Satisfy General Education Requirements.

**2.** Satisfy Bachelor of Science degree requirements (page 54).

**3.** One course in English is required in addition to the University requirement.

**4.** Minimum physics requirements: 407, General Physics I; 408, General Physics II; 505, General Physics III; 516, Physical Mechanics; 602, Thermal Physics; 605, Experimental Physics I; 606, Experimental Physics II; 609, Experimental Physics III (normally taken senior year); 701-702, Introduction to Quantum Mechanics I and II; and 703-704, Electricty and Magnetism I and II.

**5.** Additional physics courses may be selected from the following: 607,* Physical Optics; 610,** Experimental Physics IV; 613, 614, Special Topics I and II; 618,* Introduction to Solid State Physics; 695,696, Independent Study; 710, Introduction to Modern Cosmology.

**6.** Chemistry: 403-404; or Chem 405.

**7.** Math: 425-426; 527-528; plus two approved electives.

**Suggested Curriculum for Bachelor of Science Degree In Physics**

| Freshman Year | | Fall | Spring |
|---|---|---|---|
| Phys 407-408 | General Physics I and II | 4 | 4 |
| Math 425 and 426 | Calculus I and II | 4 | 4 |
| Chem 403-404 (or Chem 405 and Elective) | General Chemistry | 4 | 4 |
| Engl 401 | Freshman English | 4 | |
| Elective | Arts/humanities | | 4 |
| | | 16 | 16 |

| Sophomore Year | | | |
|---|---|---|---|
| Phys 505 | General Physics III | 4 | |
| Phys 516 | Physical Mechanics | | 4 |
| Math 527 | Differential Equations with Linear Algebra | 4 | |
| Math 528 | Multidimensional Calculus | | 4 |
| Engl Elective | Any English course | 4 | |
| C S 410 | Introduction to Computer Programming | | 4 |
| Electives (2) | Social science | 4 | 4 |
| | | 16 | 16 |

| Junior Year | | | |
|---|---|---|---|
| Phys 602 (607;618) | Thermal Physics (Optics; Solid State) | 4 | |
| Phys 701 | Quantum Mechanics I | | 4 |
| Phys 605-606 | Experimental Physics I and II | 4 | 4 |
| Biol Elective | Any Group I approved course | 4 | |
| Math 645 | Applied Linear Algebra | | |
| (646) | (Analysis for Applications) | | 4 |
| Electives (2) | Arts/humanities | 4 | 4 |
| | | 16 | 16 |

| Senior Year | | | |
|---|---|---|---|
| Phys 702 | Quantum Mechanics II | 4 | |
| Phys 703-704 | Electricity and Magnetism I and II | 4 | 4 |
| Phys 610 | Experimental Physics IV | | 4 |
| Electives (2) | Unrestricted | 4 | 4 |
| Electives (2) | Unrestricted | 4 | 4 |
| | | 16 | 16 |

*May be substituted for Phys 602 upon approval of the department.
**May be substituted for Phys 609 at any time.

# School of Health Studies

Basil J. F. Mott, Dean
Kay Amsden, Interim Associate Dean
Andrea R. Lindell, Interim Associate Dean

**Departments and Programs**

Communication Disorders
Health Administration and Planning
Medical Technology
Nursing
Occupational Therapy
Physical Education
Recreation and Parks

**Programs of Study**

**Bachelor of Science**

Communication Disorders
Health Administration and Planning
Medical Technology
Nursing
Occupational Therapy
Physical Education
- Teacher Certification
- Athletic Training
- Exercise Specialist in Health Maintenance
- Pre-Physical Therapy
- Sports Communication

Recreation and Parks
- Recreation Administration
- Park Management

## General Information

The School of Health Studies, established in 1968, is one of the newest academic components of the University. It was created in response to the growing need for programs of higher education that prepare young men and women for health and health-related careers. A major purpose of the School is development of the University's resources relating to the field of health. Currently, the school offers undergraduate instruction leading to the Bachelor of Science degree in communication disorders, health administration and planning, medical technology, nursing, occupational therapy, physical education, and recreation and parks. Each program has been designed to enable students to obtain a broad cultural background in the humanities and social sciences as well as basic knowledge and skills needed to practice their chosen professions.

### Degree Requirements

Candidates for a degree must satisfy all General Education Requirements for graduation as listed on page 15; earn at least 128 credits, including the courses required in one of the curricula described in this chapter; and achieve a minimum grade-point average in the curriculum as prescribed. Generally, courses are to be completed in the sequence in which they are arranged.

**Minors:** See page 18 for requirements.

**Dual-Degree Programs:** See page 17 for requirements.

**Student-Designed Majors:** See page 92 for requirements.

**Second Majors:** See page 17 for requirements.

#### Student Liability Insurance

All students whose programs require participation in clinical learning experiences must purchase and maintain liability insurance during the entire clinical experience. Proof of such insurance coverage must be furnished to the department before the clinical experience is scheduled to begin. The University has arranged for appropriate insurance coverage at a modest cost to students. Further information may be obtained at students' major department office.

## Communication Disorders

Communication disorders is the profession devoted to helping people overcome disabilities of speech, language, or hearing. Specialization in communication disorders begins in the freshman year. Students learn about speech, language, and hearing disorders in the usual classroom setting and then become involved in clinical practice. This opportunity is provided in an on-campus clinic and in schools and community rehabilitation clinics off campus. Students are encouraged to take elective courses in psychology, sociology, and human development.

Students' professional education should be continued at colleges or universities offering graduate programs leading to a master's degree and to subsequent certification by the American Speech and Hearing Association. Certified clinicians find employment opportunities in hospitals, schools, community speech and hearing clinics, or private practice.

Students in the Communication Disorders Program must: 1) complete a course in statistics; 2) obtain at least a 2.67 grade-point average in their first three communication disorders courses; and 3) maintain a minimum 2.75 grade-point average in all communication disorders courses. The required courses in communication disorders, which all students in the program must successfully complete, are: 520, Survey of Communication Disorders; 521, Anatomy and Physiology of the Speech and Hearing Mechanism; 524, Applied Phonetics of American English; 631, Speech Pathology I; 632, Speech Pathology II; 634, Clinical Practice in Speech Pathology; 638, The Acquisition of Language; and 704, Basic Audiology. Other elective courses are available.

Students interested in this program should consult with the chairperson, Associate Professor F. Harry Tokay.

## Health Administration and Planning

Students in the Health Administration and Planning Program are prepared to embark upon administrative and planning careers in health care agencies. Graduates will work in various settings, such as hospitals, long-term-

care facilities, official health agencies, community mental health centers, family planning agencies, insurance agencies, home health agencies, neighborhood health centers, environmental health agencies, and regulatory agencies.

The academic program is interdisciplinary, with undergraduates taking courses in many academic units of the University. Students gain a broad view of health and develop analytical skills in such areas as economics, politics, and management—all applicable to health organizations. The curriculum is organized to assist students in developing competencies in five areas. A list of these competencies is available from the program office.

Two plans are available for achieving the competencies required for graduation: the academic program for full-time students who have recently graduated from high school and the adult experiential option designed primarily for individuals who have substantial professional experience and desire to pursue the course of study while maintaining their professional affiliation.

## Academic Program for Full-time Students

Competencies are achieved through four components of the curriculum: University General Education Requirements, core area, special interest area, and collateral studies. Students must work closely with their assigned advisers to develop a plan of study for each of these components.

### General University Requirements

Advisers can assist students in selecting courses that will satisfy certain program expectations and simultaneously meet University General Education Requirements.

### Core Area

Students will enroll in: 1) introductory courses: HAP 401, Health Care Systems; HAP 402, Public Health and Human Ecology; HAP 502, Health and Medical Concepts; and 2) integrative courses: HAP 601, Administrative Problems in Health Organizations; HAP 611, Health and Social Planning; HAP 704, Financial Management of Health Care Institutions; HAP 600, Special Topics in Health Studies (each year juniors will select two one-credit courses taught by the program faculty, which may be used to complement their plan of study); HAP 701, Health Policy and Program Analysis; HAP 702, Health and Human Services: Interorganizational Relationships; and HAP 793-794, Senior Seminar.

### Special Interest Area

Students will select a health institution or a planning or administrative function within it as an area of focus. This selection usually occurs during the fall of the junior year, before the field practicum. The ten-week field practicum, an essential part of the academic program, helps integrate classwork through a supervised work experience and allows students to explore an area of special interest in depth. Courses include: HAP 602, Health Administration and Planning Field Practicum, and HAP 603, Health Administration and Planning Post-Practicum Seminar.

Electives are selected, with the guidance of the adviser, to increase an understanding of the special interest area.

### Collateral Area

A basic understanding is expected in the following areas: economics, political science, organizations, accounting, and statistics. Advisers will work with students to select the courses appropriate for their interests.

### Program Review

The faculty reviews student performances during the semester before the practicum to determine their readiness.

## Experiential Option for Adult Learners: EXCEL

This option is designed to make the B.S. with a major in health administration and planning more accessible to mature learners, many of whom have already begun a health care career. Previous learning experiences are assessed in relation to competencies established as part of degree requirements through HAP 700—Competency Assessment. Innovative educational technologies are used to aid independent learning. Many adult learners pursue the degree while continuing to work full time and without living in the Durham area. Students interested in the program should consult with the chairperson, Associate Professor David E. Berry.

## Medical Technology

Medical technology is a challenging and rewarding profession for students interested in laboratory medicine. Working with pathologists and other physicians, medical technologists are vital members of the health team performing various medical laboratory procedures and providing the diagnostic assistance required in modern patient care. Medical technologists also may be employed in research or work in a variety of industrial settings.

Students spend the freshman, sophomore, and junior years at the University and then apply for admission to the Mary Hitchcock Memorial Hospital School of Medical Technology for their senior year. After completing the required clinical courses (MedT 761-766), students are awarded 32 credits toward the Bachelor of Science degree. Student cost for the senior year, in addition to University tuition, includes room and board charges at the Mary Hitchcock School of Medical Technology. Upon successful completion of the program, students are awarded a B.S. degree and are qualified to take a certification examination.

Academic requirements for continuation in the program are as follows: 1) Students must obtain a grade of C (2.00) or better in Micr 503, 702, 705, Chem 517-518, 545-546, Bchm 656, and MedT 625, 720, 761-766. Also, students must by the end of the spring semester, sophomore year, demonstrate an overall cumulative grade-point average of 2.50 as well as a 2.50 grade-point average in the required chemistry and microbiology courses. Acceptance into the sesnior year clinical affiliation is based upon evaluation of students' academic performance and personal interviews conducted by UNH-Mary Hitchcock faculty, which are required before the end of the spring semester of the sophomore and junior years.

Students interested in this program should consult with the chairperson, Assistant Professor Karol LaCroix.

| | | Fall | Spring |
|---|---|---|---|
| **Freshman Year** | | | |
| Engl 401 | Freshman English | 4 | |
| Zool 507-508 | Human Anatomy and Physiology | 4 | 4 |
| Chem 403-404 | General Chemistry | 4 | 4 |
| Math 420 | Fundamental Mathematics | | 4 |
| MedT 401 | Introduction to Medical Technology | | 0 |
| Electives (2)* | | 4 | 4 |
| | | 16 | 16 |
| **Sophomore Year** | | | |
| Micr 503 | General Microbiology | 4 | |
| Micr 702 | Pathogenic Microbiology | | 4 |
| Chem 517 | Quantitative Analysis | 3 | |
| Chem 518 | Quantitative Analysis Laboratory | 2 | |
| Chem 545 | Organic Chemistry | | 3 |
| Chem 546 | Organic Chemistry Laboratory | | 2 |
| Electives (4) | | 8 | 8 |
| | | 17 | 17 |
| **Junior Year** | | | |
| Bchm 656 | Physiological Chemistry and Nutrition | | 4 |
| Micr 705 | Immunology and Serology | 4 | |
| MedT 625 | Clinical Microscopy | 4 | |
| MedT 720 | Clinical Mycology-Parasitology | | 4 |
| E E 620 | Electronics and Instrumentation | | 4 |
| Electives (3) | | 8 | 4 |
| | | 16 | 16 |
| **Senior Year†** | | | |
| MedT 761 | Diagnostic Microbiology Methods | 8 | |
| MedT 762 | Clinical Hematology | | 6 |
| MedT 763 | Clinical Immunology | 2 | |
| MedT 764 | Clinical Chemistry | | 8 |
| MedT 765 | Clinical Immunohematology | 6 | |
| MedT 766 | Clinical Urinalysis | | 2 |
| | | 16 | 16 |

*Students must select courses to satisfy the University General Education Requirements.

†Senior year begins in mid-August at the Mary Hitchcock School of Medical Technology. Individual rotations will vary. All students complete 16 credits each semester.

## Nursing

Professional nursing, an essential component of the total health system, is a service which requires commitment to and accountability in assisting individuals or groups to attain, maintain, and accept their optimal health states. The practice of professional nursing is an intellectual and interpersonal process which includes nursing assessment, nursing diagnosis, nursing intervention, and evaluation.

Professional nurses function as advocates for their clients and as members of the health team. They share and may coordinate and lead in planning for, implementing, and evaluating the health care of individuals and groups.

Students in the program will receive preparation in professional education with an emphasis on the humanities and social, physical, biological, and nursing sciences. Upon completion of the requirements, the student receives the Bachelor of Science degree and is eligible to take state board examinations to become a registered nurse. The program is accredited by the National League for Nursing.

Program graduates will be prepared to assume beginning positions in professional nursing and to pursue graduate study in nursing. Baccalaureate education is the minimum preparation for the practice of professional nursing.

Hospitals and many community health-related agencies are used for learning experiences. Students are responsible for their own transportation to the clinical laboratories as well as for purchase of uniforms to be worn there. A physical examination and selected immunizations, at student expense, are required within the six months before the first clinical nursing course.

All students are required to achieve a minimum of C (2.00) in each prerequisite course and to maintain a cumulative grade-point average of 2.50 by the end of sophomore year. Students must earn a grade of C or better in each nursing course with a cumulative grade-point average of 2.50 in nursing by the end of junior year and throughout the senior year.

### Expanding Baccalaureate Opportunities for Registered Nurses: EBORN

RN students who hold a current license to practice as registered nurses both in the state where employed and in the state of New Hampshire are admitted to the baccalaureate program. The baccalaureate degree for RNs is designed as an outreach part-time program which permits an individualized learning pace and continuation of present work and/or family responsibilities. The program titled EBORN (Expanding Baccalaureate Opportunities for RNs) does not include blanket endorsement of all previous education; however, advanced standing and course credit in the B.S. program may be earned. The length of the program depends upon an individual's past educational experiences, interest and ability to achieve, and advanced placement. The nursing courses are offered and sequenced to accommodate the individual learning pace. Nursing courses are designed as variable credit to enable the registered nurse adult learner (EBORN student) to challenge portion/s of a course with the permission of the faculty member or department.

Students interested in this program should consult with the chairperson, Associate Professor Andrea R. Lindell.

| **Freshman Year** | | **Fall** | **Spring** |
|---|---|---|---|
| Engl 401 | Freshman English | 4 | |
| Bchm 501 | Biological Chemistry | 4 | |
| Psyc 401 | Introduction to Psychology | 4 | |
| Nurs 402 | Nursing | | 2 |
| SHS 400 | Health-Human Values | | 4 |
| Soc 400 | Introductory Sociology | | 4 |
| Electives (3) | | 4 | 6-8 |
| | | 16 | 16-18 |
| **Sophomore Year** | | | |
| Zool 507-508 | Hum. Anatomy and Physiology | 4 | 4 |
| Mirc 501 | Public Health Microbiology | 3 | |
| Micr 502 | Public Health Microbiology Laboratory | 1 | |
| ThCo 402 | Communication I | 4 | |
| HEc 525 | Human Development | | 4 |
| HEc 575 | Normal and Therapeutic Nutrition | | 4 |
| Statistics | (See department for course) | 4 | |
| Elective | | 4 | |
| | | 16 | 16 |

| | | | |
|---|---|---|---|
| **Junior Year** | | | |
| Nurs 601 | Nursing Process | 6 | |
| Nurs 603 | Nursing Process (Well Family) | 6 | |
| Nurs 610 | Nursing Process (Environmental Influences) | | 6 |
| Nurs 612 | Nursing Process (Limited Disruptions) | | 6 |
| Electives (2) | | 4 | 4 |
| | | 16 | 16 |
| **Senior Year** | | | |
| Nurs 621 | Nursing Process (Complex Disruptions) | 6 | |
| Nurs 625 | Nursing Process (Complex Environmental Influences) | 6 | |
| Nurs 628 | Nursing Process (Man's Optimum Function) | | 8 |
| Electives (3) | | 4 | 8 |
| | | 16 | 16 |

## Occupational Therapy

The curriculum is fully accredited by the American Occupational Therapy Association and the Council on Medical Education, American Medical Association. Two years of liberal arts foundation courses and two years of professional study constitute the prescribed program leading to the Bachelor of Science degree. The program includes theoretical studies in biological and medical sciences, in psychosocial science, in the evaluation of patient and activity, and in the planning and administration of treatment, as well as the development of practical skills in a wide range of therapeutic media. Observation and guided practice of patient treatment in local clinical situations are incorporated in the course requirements. Following completion of the four-year academic program, students spend a minimum of nine months in supervised clinical practice and then are certified as eligible to sit for the national certification examination.

To continue in the major, students must have met the following criteria:

**1.** By the end of spring semester, freshman year, the student must have a 2.33 cumulative grade-point average in Engl 401, Psych 401, and Psych 581.

**2.** By the end of fall semester, sophomore year, the student must have a minimum of C (2.00) in O T 510 and Zool 507.

**3.** By the end of spring semester, sophomore year, the student must have:

**a)** a 2.33 cumulative grade-point average in courses required by the major.

**b)** a minimum grade of C (2.00) in O T 512, Zool 508, and Psych 561.

**c)** completed one O T 588 — Level I Fieldwork experience.

**4.** By the end of spring semester, junior year, the student must have a 2.33 cumulative grade-point average in courses required by the major and have completed two O T 588—Level I Fieldwork experiences.

**5.** To qualify for graduation, the student must have:

**a)** a 2.33 cumulative grade-point average in courses required by the major.

**b)** a minimum grade of C (2.00) in PhEd 606, 652; O T 515, 581, 582, 583, 624, 633, and 634.

**c)** successful completion of O T 588.

Courses required by the major are those specified in the following list with the exception of electives. A detailed list of courses that constitute class standing is available from the occupational therapy department. Students are responsible for their own transportation to off-campus clinical and learning experiences.

Upon satisfactory completion of the prerequisite courses, the department will schedule a minimum of nine months of supervised clinical practice for each student. These Level II fieldwork experiences will be scheduled in centers that have established educational programs approved in this curriculum. The fieldwork experiences are divided in three-month periods as follows: O T 711, Psychosocial; O T 712, Physical Dysfunction; and O T 713, Specialty. Students pay a fieldwork experience fee of $300 (as of May 1, 1978; this fee may be increased in 1979). The student registers for

these fieldwork experiences before graduation. Owing to a scarcity of fieldwork opportunities, the University will accept responsibility for scheduling such experiences only once for each student. Some centers may provide maintenance, but this cannot be assured. A physical examination with a tuberculin test is required before fieldwork experiences. Personal liability insurance must be purchased for the period of the Level I and Level II fieldwork experiences.

Eligible graduates make application for the June or January national certification examination through the department. A $75 fee is charged by the American Occupational Therapy Association for this examination.

Curriculum revisions are being considered; information will be available during new-student summer orientation and during the first week of classes.

Students interested in this program should consult the chairperson, Associate Professor Barbara Sussenberger.

| **Freshman Year** | | **Fall** | **Spring** |
|---|---|---|---|
| Engl 401 | Freshman English | 4 | |
| Psych 401 | Introductory Psychology | 4 | |
| Psych 581 | The Study of Child Behavior | | 4 |
| Electives (5) | | 8 | 12 |
| | | 16 | 16 |
| **Sophomore Year** | | | |
| Soc 500 | Social Psychology | 4 | |
| Zool 507-508 | Human Anatomy & Physiology | 4 | 4 |
| O T 510 | Occupational Therapy Theory | | 4 |
| O T 512 | Treatment Media Analysis I | | 2 |
| O T 531 | Group Process | 2 | |
| Arts 525 | Woodworking | 4 | |
| Psych 561 | Clinical Approaches to Human Behavior | | 4 |
| Elective | | 2 | 2 |
| | | 16 | 16 |
| **Junior Year** | | | |
| O T 515 | Treatment Media Analysis II | 4 | |
| O T 581 | Medical Concepts for for Occupational Therapists | 4 | |
| PhEd 652 | Kinesiology | 4 | |
| O T 582 | Rehabilitation Techniques | | 4 |
| O T 583 | Occupational Therapy-Psychiatric Foundations | | 4 |
| PhEd 606 | Neurology | | 4 |
| Electives (2) | | 4 | 4 |
| | | 16 | 16 |
| **Senior Year** | | | |
| O T 588 | Level I Fieldwork | | 1 |
| O T 624 | Occupational Therapy Treatment of Psychosocial Dysfunction | 4 | |
| O T 633 | Occupational Therapy Treatment for Physical Disabilities | 4 | |
| O T 634 | Level I Physical Disability Practicum | | 4 |
| O T 691 | Senior Project-Design | 1 | |
| O T 692 | Senior Project-Implementation | | 1 |
| O T 697 | Organization and Administration | 2 | |
| O T 698 | Senior Seminar | | 1 |
| Arts 519 | Weaving I | | 2 |
| Electives (G.E.R.) | | 5 | 7 |
| | | 16 | 16 |
| **Clinical Fieldwork Experiences** | | | |
| O T 711 or | General Medicine, Surgery, Pediatrics, Geriatrics | 0 | 0 |
| O T 712 | Psychiatry | 0 | 0 |
| O T 713 | Physical Disabilities and Rehabilitation | 0 | 0 |

## Physical Education

The Department of Physical Education offers five areas of study for majors: 1) teacher certification option; 2) athletic training option; 3) exercise specialist in health maintenance option; 4) pre-physical therapy option; and 5) sports communication option. Openings in options 3, 4, and 5 are limited, and option 4 is not open to entering freshmen.

The teacher certification option provides a specialized professional background and a broad general education. Students may pursue coursework to prepare as generalists (all grade levels), or as either elementary or secondary specialists in physical education. In addition to the above, students enrolled in the teacher certification option in physical education may elect to pursue an athletic training option. A cumulative grade-point average of 2.20 and a grade-point average of 2.50 in all physical education courses are required to be eligible for student teaching.

Students must complete the following coursework before student teaching: 1) all required major activity courses, 2) either PhEd 563 or PhEd 692, 3) three of the following: PhEd 620, 625, 668, 775.

Students must earn a grade of C (2.00) or better in each of the required physical education courses if majoring in any one of the following options: 1) exercise specialist in health maintenance, 2) pre-physical therapy, 3) sports communication.

Students who wish to minor in physical education must complete 20 credits of coursework which have been approved by a department minor adviser. No more than 6 of the 20 credits may be earned through activity or coaching courses.

Students interested in majoring or minoring in physical education should consult the chairperson, Associate Professor Phyllis Hoff.

### Teacher Certification Option

| Required Physical Education Courses | | Credits |
|---|---|---|
| PhEd 470-479 | Physical Education Activities (for men and women) | 7 |
| and one of the following: PhEd 447, 449, 520, 527, 533, 534 | | 1 |
| PhEd 480-483, 485 | Physical Education Activities (for men) | 2.5 |
| PhEd 484, 486-491 | Physical Education Activities (for women) | 3.5 |
| One from the following: PhEd 410, 415, 416, 427, 428, 435, 437, 438, 439, 449, 453, 533, 534 | | .5/1.0 |
| One course from the following: PhEd 411, 412, 414, 417, 419, 420, 421, 422, 423, 424 | | .5 |
| PhEd 500 | Perspectives in Physical Education | 4 |
| PhEd 501 | Advanced First Aid and Emergency Care | 2 |
| PhEd 620 | Physiology of Exercise | 4 |
| PhEd 668 | Measurement Procedures in Physical Education | 4 |
| PhEd 775 | Perceptual Motor Learning | 4 |
| One of the following: | | |
| PhEd 563 | The Theory of Teaching Physical Education in the Secondary School | 4 |
| PhEd 692 | Theories of Teaching Physical Education in the Elementary School | 4 |
| One of the following: | | |
| PhEd 625 | Dynamics of Human Movement | 4 |
| PhEd 652 | Kinesiology | 4 |
| **Education Courses** | | |
| Educ 500 | Exploring Teaching | 4 |
| Educ 700 | Educational Structure and Change | 4 |
| Educ 701 | Human Learning and Development | 4 |
| Educ 705 | Alternative Perspectives on the Nature of Education | 4 |
| Educ 694 | Supervised Teaching of Physical Education | 8 |
| **University Required Courses** | | |
| Psyc 401 | Introduction to Psychology | 4 |
| Zool 507-508 | Human Anatomy and Physiology | 8 |

## Athletic Training Option

This option has limited enrollment capacity and is open only to students enrolled in the physical education teacher certification curriculum. Application for admission to the option is made through the department chairperson following completion of PhEd 502. Completion of all program requirements normally requires four and one-half to five years of study. In addition to the teacher certification curriculum requirements, students admitted to the athletic training option must complete HEc 573, Human Nutrition; SHS 400, Health-Human Values; O T 581, Medical Concepts for Occupational Therapists; and the following required courses:

**Physical Education Courses**

| | | |
|---|---|---|
| PhEd 502 | Basic Athletic Training | 4 |
| PhEd 606 | Neurology | 4 |
| PhEd 610 | Adapted Physical Education | 4 |
| PhEd 652 | Kinesiology | 4 |
| PhEd 702 | Advanced Athletic Training | 4 |
| PhEd 703 | Laboratory Practice in Athletic Training | 8 |
| PhEd 780 | Psychological Factors in Sport | 4 |

## Exercise Specialist in Health Maintenance Option

This curriculum prepares individuals for career opportunities in adult fitness programs in communities, industry, and health agencies. Exercise specialists work in physical activity programs of prevention, intervention, and cardiac rehabilitation. Students must complete all required physical education courses prior to enrolling in PhEd 650. Required courses are:

**Physical Education Courses**

| | | |
|---|---|---|
| PhEd activities | (must include 475 and one of the following: 447, 520, or 527) | 6 |
| PhEd 501 | Advanced First Aid and Emergency Care | 2 |
| PhEd 502 | Basic Athletic Training | 4 |
| PhEd 620 | Physiology of Exercise | 4 |
| PhEd 621 | Exercise Laboratory Techniques | 3 |
| PhEd 622 | Therapeutic Exercise and Exercise Prescription | 3 |
| PhEd 650 | Exercise Specialist Internship | 8 |
| PhEd 652 | Kinesiology | 4 |
| PhEd 668 | Measurement Procedures in Physical Education | 4 |

**University Required Courses**

| | | |
|---|---|---|
| AnSc 506/HEc 506 | Principles of Nutrition | 4 |
| Bchm 501 | Biological Chemistry | 4 |
| Psyc 401 | Introduction to Psychology | 4 |
| Psyc 561 | Clinical Approaches to Human Behavior | 4 |
| Zool 507-508 | Human Anatomy and Physiology | 8 |

## Pre-Physical Therapy Option

The pre-physical therapy curriculum provides the necessary courses for meeting admission requirements to a physical therapy certificate program. However, satisfactory completion of all UNH degree requirements does not guarantee admission to one of the several physical therapy schools. In addition to the required courses listed below, work experience in a rehabilitation setting is highly recommended.

**Physical Education Courses**

| | | |
|---|---|---|
| PhEd major activities | (must include 470, 472, and either 520 or 527) | 6 |
| PhEd 502 | Basic Athletic Training | 4 |
| PhEd 606 | Neurology | 4 |
| PhEd 620 | Physiology of Exercise | 4 |
| PhEd 622 | Therapeutic Exercise and Exercise Prescription | 3 |
| PhEd 652 | Kinesiology | 4 |
| PhEd 775 | Perceptual Motor Learning | 4 |
| One of the following: | | |
| PhEd 675 | Motor Development of the Young Child | 4 |
| PhEd 740 | Perceptual Motor Dysfunction | 4 |

**University Required Courses**

| | | |
|---|---|---|
| Chem 403-404 | General Chemistry | 8 |
| Phys 403-404 | Introductory Physics for Biologists | 8 |
| Psyc 401 | Introduction to Psychology | 4 |
| Soc 500 | Social Psychology | 4 |
| Zool 507-508 | Human Anatomy and Physiology | 8 |
| One of the following: | | |
| Psyc 531 | Psychobiology | 4 |
| Psyc 561 | Clinical Approaches to Human Behavior | 4 |
| Psyc 711 | Sensation and Perception | 4 |

| | | |
|---|---|---|
| One of the following: | | |
| HEc 525 | Human Development | 4 |
| Psyc 581 | The Study of Child Behavior | 4 |
| One of the following: | | |
| Inco 650 | Introductory Statistics | 4 |
| INER 528 | Applied Statistics I | 4 |
| INER 701 | Statistical Methods I | 4 |
| Psyc 601 | Statistics and Methodology in Psychology | 4 |
| Soc 602 | Statistics | 4 |

### Sports Communication Option

The sports communication option combines substantive knowledge in sport with skills in mass communication, including sportswriting and sportscasting. A grade of B- or better is required in Engl 501 to continue this option. Most students in the sports communication option also participate in the English Department journalism program. For these students, an excellent record of performance in the writing courses is required. An internship experience is recommended for highly qualified students. Required courses are as follows:

**Physical Education Courses**

| | | |
|---|---|---|
| PhEd activities | | 6 |
| PhEd coaching courses | | 6 |
| PhEd 633 | Social Foundations of Sport and Physical Activity | 4 |
| PhEd 635 | Sport in Literature | 4 |
| PhEd 668 | Measurement Procedures in Physical Education | 4 |
| PhEd 780 | Psychological Factors in Sport | 4 |
| PhEd 791 | History of Physical Education | 4 |

**University Required Courses**

| | | |
|---|---|---|
| Engl 501 | Introduction to Prose Writing | 4 |
| Engl 621 | Newswriting | 4 |
| Psyc 401 | Introduction to Psychology | 4 |
| Soc 400 | Introductory Sociology | 4 |
| ThCo 402 | Communication I | 4 |
| ThCo 403 | Public Speaking | 4 |
| One of the following groups of courses: | | |
| Engl 622 | Newswriting | 4 |
| Engl 703 | Advanced Nonfiction Writing | 4 |
| ThCo | Elective (a communication course) | 4 |
| ThCo 555 | Introduction to Mass Communication | 4 |
| ThCo 556 | Introduction to Television Production | 4 |
| Engl | Elective (a writing course) | 4 |

## Recreation and Parks

The undergraduate program in recreation and parks offers training for service in recreation administration and in park management. The courses of study in each area provide a base in the fundamentals of professional specialization and an exposure to the current leisure trends and needs of a rapidly changing economy and society.

### Professional Curriculum Options

Professional options are offered in recreation administration and in park management, leading to a Bachelor of Science degree. Students must earn a grade of C (2.00) or better in each of the required recreation and parks courses.

Curriculum revisions are being considered in each of the professional options. Students will be informed of approved changes before enrollment in the program. For a more complete description of courses, contact the recreation and parks office.

#### Recreation Administration

This specialization is designed to identify and develop the abilities which will prepare students for administrative and programming supervisory positions in the recreation fields. Students selecting this option are required to complete 128 credit hours for the degree.

| Freshman Year | | Fall | Spring |
|---|---|---|---|
| Polt 402 | American Politics and Culture | | 4 |
| Biol 402 | Man and His Environment | | 4 |
| REco 411 | Introduction to Resource Economics | 4 | |
| RecP 455 | Introduction to Recreation and Park Services | 4 | |
| RecP 454 | Special Facility Operations | | 4 |
| Electives (3) | General Education Requirements | 8 | 4 |
| | | 16 | 16 |

| Sophomore Year | | | |
|---|---|---|---|
| Polt 503 | Local Government and Politics | | 4 |
| Polt 502 | State Government and Federalism | | 4 |
| REco 507 | Introduction to Community and Community Development | 4 | |
| RecP 457 | Dynamics of Leadership and Programming | 4 | |
| Electives (4) | General Education Requirements | 8 | 8 |
| | | 16 | 16 |

| Summer | | |
|---|---|---|
| RecP 564 | Field Work | 8 |

| Junior Year | | | |
|---|---|---|---|
| Polt 500 | American Public Policy | 4 | |
| Admn 517 | Survey of Basic Accounting | 4 | |
| Admn 411 | Behavior in Organizations | | 4 |
| RecP 663 | Recreation and Park Administration | 4 | |
| RecP 667 | Recreation and Resource Planning | | 4 |
| RecP Elective (1) | Recreation and Parks | 4 | |
| Electives (2) | General Education Requirements | | 8 |
| | | 16 | 16 |

| Senior Year | | | |
|---|---|---|---|
| Polt 702 | Public Planning and Budgeting | 4 | |
| RecP 771 | Legal Aspects | | 4 |
| RecP 798 | Seminar in Leisure | | 4 |
| RecP 772 | Financial Administration | | 4 |
| Electives (2) | General Education Requirements | 8 | |
| | | 12 | 12 |

**Park Management**

This specialization is concerned with economics, planning, and supervision, including the identification, acquisition and allocation, development, and maintenance of land and water resources for recreational purposes. Students selecting this option must complete 128 credit hours for the degree.

| Freshman Year | | Fall | Spring |
|---|---|---|---|
| Hydr 504 | Freshwater Resources | | 4 |
| RecP 455 | Introduction to Recreation and Park Services | 4 | |
| REco 411 | Introduction to Resource Economics | 4 | |
| RecP 454 | Special Facility Operations | | 4 |
| Bot 411 | General Botany | 4 | |
| Electives (3) | General Education Requirements | 4 | 8 |
| | | 16 | 16 |

**Sophomore Year**

| | | | |
|---|---|---|---|
| PlSc 522 | Environment and Plant Response | | 4 |
| REco 507 | Introduction to Community and Community Development | 4 | |
| RecP 661 | Recreation Resources Management | 4 | |
| RecP Elective (1) | Recreation and Parks | | 4 |
| Electives (4) | General Education Requirements | 8 | 8 |
| | | 16 | 16 |

**Summer**

| | | | |
|---|---|---|---|
| RecP 564 | Field Work | | 8 |

**Junior Year**

| | | | |
|---|---|---|---|
| Admn 517 | Survey of Basic Accounting | | 4 |
| RecP 663 | Recreation and Park Administration | 4 | |
| RecP 667 | Recreation and Resource Planning | | 4 |
| RecP 668 | Designing and Engineering | 4 | |
| REco 606 | Land Economics and Use | | 4 |
| RecP Elective (1) | | | 4 |
| Electives (2) | General Education Requirements | 8 | |
| | | 16 | 16 |

**Senior Year**

| | | | |
|---|---|---|---|
| INER 797 | Forest Recreation Seminar | 4 | |
| INER 702 | Natural Resources Policy | | 4 |
| RecP 771 | Legal Aspects | | 4 |
| RecP 798 | Seminar in Leisure | | 4 |
| Electives (2) | General Education Requirements | 8 | |
| | | 12 | 12 |

# Whittemore School of Business and Economics

Charles B. Warden, Jr., Dean
Dwight R. Ladd, Associate Dean
Mary Anne Sharer, Assistant Dean
Wayne M. Burton, Assistant to the Dean
Donald A. Moore, Director of
Center for Industrial and
Institutional Development
Virginia Tripp, Lois Grossman,
Undergraduate Counselors

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**Programs of Study**

**Bachelor of Arts**

Economics

**Bachelor of Science**

Administration
Hotel Administration

## General Information

### Purpose and Programs

The Whittemore School of Business and Economics was established July 1, 1962, as the result of the efforts of the late Laurence F. Whittemore, noted industrialist and long-time trustee and chairman (1955-60) of the UNH Board of Trustees. Since 1969, the school has been housed in McConnell Hall, named for Dr. John W. McConnell, the fourteenth president of the University (1963-71).

The basic purpose of the undergraduate curricula in the Whittemore School is to combine the breadth of liberal education with the specifics of professional training in administration, economics, and hotel administration. Undergraduates enrolled in the Whittemore School programs must take a substantial part of their coursework in other colleges in the University in order to fulfill UNH's General Education Requirements. Beyond those requirements, students are encouraged to elect additional courses in the arts, the behavioral and social sciences, the humanities, mathematics, and the natural sciences. Thus, students who complete the Whittemore School programs in administration, economics, and hotel administration are prepared for employment and graduate study in these and related fields.

Another purpose of the Whittemore School is to serve the needs of undergraduates elsewhere in the University for whom selected courses in administration, economics, or hotel administration are relevant and desirable complements to their primary course of study. Most Whittemore School courses, therefore, are open to nonmajors who have the prerequisite preparation.

### Degree Requirements

The Whittemore School offers a Bachelor of Arts degree program in economics and Bachelor of Science degree programs in administration and hotel administration. Candidates for a degree must satisfy all of the University General Education Requirements for graduation as well as the particular requirements of the individual major program. Economics majors must also satisfy specific requirements associated with the Bachelor of Arts degree. (See page 16.)

The curricula of the Whittemore School undergo timely revision and modification, and students are subject to and responsible for such changes as they are introduced. However, entering students may anticipate that a curriculum, as represented and as subsequently altered, can be completed in four academic years, assuming normal course loads are carried and normal progress is made. In sum, then, Whittemore School students generally follow the current catalog. New catalogs become effective on July 1 of each year.

For information concerning advanced degrees, see the Graduate School catalog.

### Advising System

Undergraduate advising in the Whittemore School is carried out jointly by an undergraduate counselor and the faculty. The undergraduate counselor is based in the dean's office, where student academic records are kept. The counselor assists students in program planning, preregistration, understanding and meeting academic requirements, and general academic and career decision making. The faculty draw on their experience, expertise, and interests to help students with course, program, and career selection.

Students are not officially assigned to faculty advisers, but are provided with a Whittemore School *Faculty Profiles* booklet, which contains considerable information about faculty members' education, experience, and current teaching and research interests. Undergraduates are encouraged to develop an advisory relationship with one or more faculty members on the basis of mutual interests. Students who prefer a more formally structured arrangement are urged to so inform the undergraduate counselor, and such an arrangement will be made with either the associate or assistant dean. All students are urged to seek as much assistance as they need, from whatever source, but are reminded that theirs is the ultimate responsibility for knowing and meeting the various academic requirements for a degree.

### Independent Study/Internship

Juniors or seniors in the Whittemore School may elect the internship or independent study options for variable credit. For either option, the student must secure a faculty sponsor in the area of interest and submit a proposal prior

to the semester in which the project is to be undertaken. Independent study normally involves research, while internships are usually undertaken with cooperation of an off-campus organization and involve the nonroutine, but practical application of skills and concepts acquired in a student's program.

Independent studies and internships require considerable self-direction and self-monitoring on the part of the student, and careful prior review of requirements with the undergraduate adviser is necessary.

### Five-Year Programs; B.A.-M.B.A., B.S.-M.B.A.

The Whittemore School and the College of Engineering and Physical Sciences offer a joint program leading to a Bachelor of Science (B.S.) in chemical engineering, civil engineering, electrical engineering, or mechanical engineering and a Master of Business Administration (M.B.A.) in five years rather than the normal six. Similarly, with the College of Liberal Arts, the Whittemore School offers a joint program leading to a B.A. in French, history, philosophy, or psychology and an M.B.A. The College of Life Sciences and Agriculture and the Whittemore School offer a joint program leading to a B.S. in Plant Science and an M.B.A. See the individual college descriptions for details.

## Administration Program

The Administration Program provides training for young men and women interested in managerial or administrative careers in business or in public or private institutions.

Since most graduates of the program elect to embark upon business careers, the major thrust is in that direction. However, as demand has grown in recent years for people able to apply businesslike methods to the problems of nonprofit institutions, such as hospitals, school systems, government departments, and other socially oriented organizations, the program's objectives have been broadened considerably to include all types of administration, rather than business only.

The curriculum offers professional education in the basic theories, principles, concepts, and analytical tools used by successful modern administrators, combining them with an introduction to some of the important functional areas of management. At the same time, typical students achieve a well-rounded education by selecting courses in the liberal arts and the sciences from other colleges and schools in the University.

The Administration Program consists of nine required courses in three groupings. Group A includes the five core courses taken in the freshman and sophomore years. These focus on basic concepts, tools, and skills. Group B consists of three courses in the functional areas of production, marketing, and finance, normally taken in the junior and senior years. Group C includes the final capstone course in administration, taken in the senior year.

Students must achieve a minimum grade-point average of 2.00 in Group A courses before any Group B courses may be taken. In order to graduate, students must achieve a grade-point average of at least 2.00 in the nine major courses. Transfer students must complete five courses in the program at UNH in order to qualify as majors. Credit toward the administration major is not normally given for Group B or C courses taken at the first or second-year level elsewhere.

Students are encouraged to take advanced electives in areas of their interest and in relation to career goals. Faculty members and the undergraduate counselor can provide useful information and guidance for choices of electives.

Students not majoring or minoring in administration are encouraged to consider courses in accounting, organizational behavior, finance, marketing, production, etc., as relevant supplements to their own program of study. Advice concerning courses appropriate to various career goals may be obtained from members of the administration faculty.

The required plan of study is given below:

**Freshman and Sophomore Years (Group A)**

Econ 401, Principles of Economics (Macro); Econ 402, Principles of Economics (Micro); Admn 411, Behavior in Organizations; Admn 424, Quantitative Analysis; Admn 502, Financial Accounting

**Junior and Senior Years (Group B)**

Admn 650, Operations Management; Admn 651, Marketing; Admn 653, Financial Management

**Senior Year (Group C)**

Admn 700, Business Policy

**A minor in administration** is available to students in the arts and sciences and in technical or professional programs who may want to become managers or administrators in their own fields, or who want to generally enhance their employability. The minor in administration consists of: Econ 402, or in some cases, Econ 401, but not both; Admn 411 and 424; and Admn 502 or 517, but not both; and one elective.

Students who wish to minor should obtain information from the undergraduate counselor.

## Economics

Economics is the study of the allocation of scarce resources among competing uses, either through use of conscious public policy ("planning") or through impersonal market forces, the maintenance of full resource use, and the distribution of output. The analytical skills of economists are useful in evaluating alternative methods of achieving these goals and in the formulation of new approaches to problems in these areas.

The economics program is designed to introduce students to the tools of economic analysis and to an understanding of the areas to which they may be usefully applied.

While undergraduate training in economics does not qualify students as professional economists (those intending such a career should plan on graduate study), it is regarded by employers as a highly desirable background for business or governmental employment. In recent years, economics graduates have competed on a favorable basis for business and government jobs with graduates in other areas, including administration. Undergraduate economics training is an excellent background for graduate work in law, business administration, and international relations, as well as economics.

Students planning to pursue graduate study in economics should consult with their advisers or faculty members early in the academic program to assist in their selection of an appropriate graduate school and to aid in gaining admission.

Courses in economics, including a minor program, are open to nonmajors. Students majoring in other programs may find certain economics courses useful supplements to their own majors and an aid in future employment. Political science majors may be interested in courses in economic development, comparative economic systems, public finance, and government regulation of business; engineering and science students, in statistical theory, introduction to econometrics, and intermediate microeconomic analysis. Noneconomics majors with questions about the nature of various courses should feel free to question the economics faculty.

Economics majors must complete eight full courses in economics with a grade of at least C- (1.67) in each course and achieve at least a 2.00 grade-point average. These must include both intermediate theory courses, Econ 605 and 611. Students must also pass Econ 525, Introduction to Economic Statistics, or equivalent as determined by the economics faculty. (Students may petition to substitute one 600- or higher-level administration or resource economics course for an economics elective.) Major credit toward Econ 605 and/or 611 will be awarded transfer students only if such courses have been taken at the junior level or above. Transfer students must take five of their eight economics courses at UNH. All economics majors must satisfy the Bachelor of Arts degree requirements (page 16).

A suggested plan for economics majors is given below:

**Freshman and Sophomore Years**

Econ 401, 402, Principles of Economics (Macro and Micro); Econ 525, Introduction to Economic Statistics

**Junior Year**

Econ 605, Intermediate Microeconomic Analysis; Econ 611, Intermediate Macroeconomic Analysis

**Senior Year**

Economics electives (3)

**A minor in economics** consists of Econ 401, 402; Econ 605 or 611 or 635; and two economics electives.

## Hotel Administration

The Hotel Administration Program objective is to prepare students to perform managerial-level jobs in enterprises and institutions of the service sector, which have lodging and/or food service components. The service sector includes lodging, food service, tourism, and recreation industries, and institutions such as hospitals and schools.

The program design recognizes that in order to have a well-rounded University education, students need a course foundation in business administration and economics as well as the liberal arts. The hotel administration courses build upon such a foundation and provide experience and in-depth education specifically in the lodging and food service industries.

The program is also designed to include a mix of practical experience along with classroom activities. These practical experiences are provided in the operation of a campus food service facility, catering services, gourmet dinners and major consulting projects to industry (as part of classroom projects), lecture series, seminars and field trips, and a required summer of related work experience.

The Hotel Administration Program consists of 12 required courses in three groupings. Group A consists of six core courses taken in the freshman and sophomore years. Group B includes most of the functional areas needed for developing successful management skills. These are generally taken in the sophomore and junior years. Group C includes Hotl 666, taken in the senior year.

Students must achieve a minimum grade point average of at least 2.00 in Group A courses before Group B courses may be taken. The same relationship applies between Group B and Group C courses.

Students in the Hotel Administration Program must obtain a grade-point average of 2.00 or better in the required courses given in the Whittemore School. Graduates of this program, who are qualified for and interested in further allied studies, are well prepared for advanced degree programs in business or institutional administration.

A suggested plan of study is given below.

**Freshman and Sophomore Years (Group A)**

Hotl 403, Elements of Institutional Administration; Admn 411, Behavior in Organizations; Econ 401, Principles of Economics (Macro); Econ 402, Principles of Economics (Micro); Admn 424, Quantitative Analysis; Admn 502, Financial Accounting

**Sophomore and Junior Years (Group B)**

Hotl 518, Financial Analysis and Control; Hotl 556, Management of Physical Structures; Admn 651, Marketing; Hotl 655, Management for Transient, Leisure, and Institutional Services; Hotl 667, Functional Management

**Senior Year (Group C)**

Hotl 666, Markets and Promotion of Public Service

## Secretarial Studies

The Whittemore School also offers courses in secretarial studies, including introductory and advanced typing and shorthand, for all students in the University.

# Special University Programs

## Preprofessional Programs

### Prelaw

Students who intend to apply for admission to law school are not required to follow a specific undergraduate curriculum; there are goals, however, that they ought to pursue in planning their undergraduate program. Law schools expect students to follow a program of study that develops breadth of view, facility of expression, and analytical capacity. They urge undergraduates to acquire a background of information concerning their society and the forces that have shaped modern institutions. The competent use and understanding of written and spoken English are essential for those planning to attend law school.

Students should choose courses of study which allow them to develop these capabilities. Specific course selections can be discussed by students and their advisers, but some general guidelines may be offered. Helpful courses are those that deal with political, economic, and analytical thinking and that provide an understanding of the human mind.

Students who hope to enter law school should contact a member of the University Prelaw Committee to discuss courses of study and other matters related to law school admission. Those who are considering taking the Law School Admission Test (LSAT) should schedule the examination in October or December of the senior year and should discuss the examination with a member of the Prelaw Committee before taking it. Members of the Prelaw Committee are: John R. Kayser, chairperson, Department of Political Science; Richard V. Desrosiers, Ancient and Modern Languages and Literatures; Michael Jones, Whittemore School; and William Jones, History.

### Premedical-Predental Program

Students considering careers in medicine or dentistry should become familiar with the minimum course requirements as early as possible, so that specific courses needed for application to medical and dental schools can be incorporated into their programs. The premedical-predental program is not a major with a rigidly prescribed curriculum; rather, it is the acknowledgment of students' professional intentions. Although a majority of students in the past have elected zoology as a major, there is a trend, particularly in premedicine, away from exclusive concentration in a single area of science. In recent years, students from UNH have chosen to major not only in sciences such as zoology, microbiology, biochemistry, and chemistry, but also in such fields as history, English, psychology, and political science.

Students will choose a major subject based on their own interests and aptitudes and will be assigned an appropriate faculty adviser from that department or school. The responsibility of the Premedical-Predental Advisory Committee is to offer information about medical and dental admission requirements and procedures and to provide recommendations at the time of application.

All medical and dental schools expect applicants to have demonstrated ability in basic natural and physical sciences. Although the specific requirements for admission vary considerably, the following courses constitute a minimum in order for students to be considered for admission: biological sciences, physics, general chemistry, and organic chemistry, all two semesters each with laboratory; and mathematics through calculus. Proficiency in English and a foreign language is strongly recommended. An appropriate group of courses from among the offerings at the University of New Hampshire would be the following: Zool 412, 518; Phys 403-404 (or 407-408); Chem 403-404, 651-652, 653-654; and Math 425-426. One semester of biochemistry (Bchm 501 or 601) also will be required by some dental schools.

Courses which qualify individuals for consideration as premedical or predental students should be completed by the time application to a professional school is submitted, usually by the end of the junior year. Inasmuch as performance in these courses is weighted heavily by the admissions committees, it is strongly recommended that students not register for them under the pass/fail grading alternative.

Interested students should contact the Premedical-Predental Advisory Committee office as soon as possible.

## Interdisciplinary Programs

In addition to the general University interdisciplinary opportunities described in this section, other ways of combining studies are mentioned in the program information of the various colleges and schools. Some of the more specific opportunities are: biomedical systems and instrumentation minor, page 55; community development, page 45; dual degrees, page 17; environmental conservation, page 46; environmental engineering minor, page 56; five-year B.A.-M.B.A. program, page 23; five-year, B.S.-M.B.A. program, page 42 and page 54; forest resources, page 47; general studies, page 44; humanities major, page 30; hydrology, page 48; independent study and projects in the College of Engineering and Physical Sciences, page 56; interdisciplinary mathematics (8 options), page 69; interdisciplinary science—B.A., science major, chemistry concentration, page 60, earth sciences concentration, page 63, mathematics concentration, page 68, physics concentration, page 72; materials science minor, page 55; linguistics major, page 30; minors, page 18; ocean engineering minor, page 55; oceanography minor, page 56; philosophy special-interest program, page 33; resource economics, page 49; second majors, page 17; soil science, page 50; student-designed majors, page 92; wildlife management, page 50; women's studies minor, page 39.

### Student-Designed Majors

Under special circumstances, students may design their own majors. This option is offered for highly motivated and independently disciplined students who seek a course of study that is not available through existing programs at the University. It allows students, with the close supervision of faculty members, to cross department and college lines and to create educational experiences on and off campus as part of individual programs of study.

Student-designed majors are administered by a committee of elected faculty that operates through the Office of the Vice President for Academic Affairs. Students who want to design their own majors are expected to give the committee evidence of careful thought and planning in a detailed proposal submitted before the middle of their junior year. Proposal guidelines are available in the Office of the Vice President for Academic Affairs.

### Teaching-Learning Council

The Teaching-Learning Council, an extraordinary committee established by the Academic Senate, is charged with encouragement of excellence and innovation in undergraduate teaching. To this end, the council is exploring many approaches—colloquia, video tape equipment, a Teaching Resource Center, and so on—which may lead to improvement in teaching.

In cooperation with the Teaching-Learning Committee in each of the University's colleges and schools, the council supports development of new approaches to teaching in existing or new courses, and promotes development of experimental and interdisciplinary courses and programs by faculty members and other qualified persons. Courses under council sponsorship are normally offered for one semester, though some have been repeated.

#### Intercollege Courses

The Independent Work-Study courses and the modular Introductory Statistics course are continuing offerings and are listed in the course descriptions, pages 169-170.

### Interdepartmental Biology Major

The interdepartmental biology major is designed with a common core curriculum from which programs of study are available for: 1) preparation for teaching biology in secondary schools; and 2) preparation for professional careers in biology or graduate study. Completion of the four-year undergraduate program plus a fifth-year internship will be necessary for biology teacher certification.

Students are advised to declare the biology major as incoming freshmen to assure adequate program planning. The major is offered in both the College of Liberal Arts and the College of Life Sciences and Agriculture under the supervision of the Inter-College Biological Sciences Organization. Students who wish a more specialized program or who do not plan to teach secondary school should consider a major in animal sciences, biochemistry, botany, entomology, microbiology, plant science, or zoology.

Major and supporting courses in the following list should be taken in the sequence given. Students planning to teach should enroll in Educ 500 during their sophomore year

and should consult with the Department of Education on further courses in that field. Those not planning to teach will instead take three advanced biological science or supporting courses. Graduation requirements include a 2.00 cumulative grade-point average in the courses prescribed in the major. A grade of C- (1.67) or better is required in 11 biological science courses. Students majoring in one of the biological science departments may not minor in biology. The biology major is not recommended for students planning to go to medical school.

Students interested in the biology major should contact either Professor Frank K. Hoornbeek or (if planning to teach) Ms. Abigail R. Lumsden, Department of Zoology, Spaulding Life Science Center.

**Major Course Sequence**

Note: Except for science courses, University General Education Requirements are not included. (See General Education Requirements, page 15.)

**Freshman Year:**

Bot 411 or 412, Zool 412, Chem 403-404, Math 425

**Sophomore Year**

Chem 545, Zool 518, Zool 527, Biol 541, Educ 500*, Bot 566

**Junior Year**

Phys 403-404, Bot or PlSc 606, Micro 503, education*, advanced biology, or supporting courses†.

**Senior Year**

Ento 402, Zool or PlSc 604, a 700-level botany course, education*, advanced biology, or supporting courses†.

*For teacher preparation, consult the Department of Education.
†For nonteacher preparation, substitution of Chem 651-652 for Chem 545 early in the program, and the second semester of calculus are suggested for graduate school preparation.

## Genetics

An undergraduate degree in genetics is not offered at the University of New Hampshire. In the Graduate School, the M.S. and Ph.D. degrees are offered in an interdepartmental Genetics Program. For courses offered in the program, some of which may be taken by undergraduates, refer to the Graduate Catalog. Students interested in preparing for graduate work in genetics at UNH or elsewhere should contact the chairperson of the Genetics Program early in their undergraduate careers for advice on courses.

## History and Philosophy of Science Minor

This interdisciplinary minor is designed for students who wish to study the historical and philosophical foundations of the natural and social sciences. It may be combined with any undergraduate major field. General introductions to any of the disciplines are not among the goals; rather, the objective is to acquire skills in historical thinking and critical analysis relevant to the discovery, growth, and application of scientific knowledge.

Further information is available from the Advising Center, Murkland Hall, including annual listings of the courses and instructors. Any instructor teaching one of the courses may serve as a contact person. A minor consists of any five of the courses listed, with no more than three from any single department.

History 521. History of Science (to the Renaissance)
History 522. History of Science (post-Renaissance)
History 722. History of American Thought
History 751. European Intellectual History
History 752. European Intellectual History
History 789. Seminar in the History of Science
Philosophy 424. Science, Technology, and Society
Philosophy 435. The Human Animal
Philosophy 630. Philosophy of Natural Science
Philosophy 683. Technology. Its Role and Function in Society
Philosophy 725. Philosophy of Social Science
Philosophy 780. Special Topics in Philosophy*
Psychology 471. The Great Psychologists
Psychology 591. Special Topics*
Psychology 671. History of Psychology
Psychology 771. Survey of Twentieth-Century Psychology

*with approval

### International and Foreign Area Studies Minor

This minor, designed to meet the needs of undergraduates who wish to pursue their studies with an international or an area focus, provides interdisciplinary support for students' major interests. Students interested in this minor should consult the minor requirements in their respective colleges and schools. The program will be administered by an international studies minor supervisor.

A minor in international and foreign area studies consists of 20 credits (normally five courses) and knowledge of a foreign language. Courses that may be applied toward this minor are listed in the *Bulletin for International and Foreign Area Studies Minors*, which is available from the international studies minor supervisor. For approval of the minor, students must meet the following requirements:

**1.** Complete a minimum of one and a maximum of two courses from a list of general international courses.

**2.** Select a foreign area from among the six offered (Asia, West Europe, Soviet and East Europe, Africa and the Middle East, Canada, Latin America) and complete a minimum of three and a maximum of four courses from among those listed for that area.

**3.** Demonstrate knowledge of a foreign language relevant to the selected geographic area. This requirement will ordinarily be met by either:

**a.** Successful completion of the following courses in a language relevant to the area: Fren 504 or 514; Germ 504; Ital 504; Portuguese (see "c"); Russ 504; or Span 504.

**b.** Successful completion of courses taught in the relevant language above the level of the courses listed in "a."

**c.** Certification by the language department concerned. Students who select an area in which no relevant language is currently being offered or students with a knowledge of a foreign language not offered in University language programs should contact the international studies minor supervisor.

**4.** No more than two courses from any one department may be applied toward the minor.

**5.** With the approval of the international studies minor supervisor, courses taken during the junior year abroad (Salzburg, Austria; Dijon, France; or Valencia, Spain) can be counted toward the minor.

For further information students may contact: Associate Professor B. Thomas Trout, Department of Political Science, international studies minor supervisor.

### Marine Science and Ocean Engineering

The University is centrally situated on the northern New England coast near a variety of estuarine, coastal, insular, and continental shelf marine environments. This ideal location has resulted in a long-standing history of educational and research activities which currently are being pursued within the areas of the marine life; the physical and social sciences; ocean engineering; and chemical, geological, and physical oceanography. Supporting facilities include the Marine Program Building, the Engineering Design and Analysis Laboratory and its Dimond Island Ocean Engineering Station, the Mechanics Research Laboratory, the Jackson Estuarine Laboratory, the Visitor Interpretive Center at Odiornes Point State Park, the Portsmouth Pier facility, the Shoals Marine Laboratory, departmental laboratories and shops, the 45-foot R/V *Jere A. Chase*, another 50-foot research vessel, and several smaller vessels. A SCUBA diving program also supports these activities.

#### Oceanography

Students who wish to prepare for a career in oceanography should have a good foundation in the basic sciences. As a minimum, they should elect Chem 403-404, Math 425-426, and Phys 407-408. Students should enroll as a major in one of the established science disciplines closest to their principal area of interest. An adviser in the department will help students select additional courses. Those students interested in chemical, geological, or physical oceanography should consult with Professor Herbert Tischler, Department of Earth Sciences. Students with interests in the area of biological oceanography should contact Professor John E. Foret, Department of Zoology; Professor Arthur C. Mathieson, Department of Botany; or Professor Galen E. Jones, Department of Microbiology. Usually additional work at the graduate level is necessary in the field of oceanography.

In addition to the courses necessary to attain a degree in a specific discipline, students should, in consultation

with their advisers, consider some of the following courses which are available to undergraduates: 1) Botany: 525, 721, 722, 723; 2) Earth Sciences: 501, 502, 734, 741, 752, 754, 758, 759; 3) Microbiology: 503, 600, 707, 708; 4) Zoology: 412, 528, 542, 604, 628, 674, 715, 724, 772, 775.

Students who plan on taking some of the above courses in addition to courses in their academic major should consider the minor in oceanography (see page 56).

**Ocean Engineering**

Study and research in the application of engineering knowledge to the ocean and contiguous land environments are pursued by all four engineering departments of the College of Engineering and Physical Sciences. An undergraduate ocean engineering minor program, composed of both lecture and project-type courses, is designed to prepare undergraduate engineering students for ocean-related employment after graduation or for graduate degree programs in ocean engineering. Successful completion of the program is certified on the students' transcripts. The details of the ocean engineering minor program are given on page 55.

The application of theory to the solution of real problems in the marine environment is an essential part of the undergraduates' education. It is achieved through student participation in the ocean research and project activities led by faculty associated with the College's Engineering Design and Analysis Laboratory (EDAL) and, from time to time, by individual faculty from any one of the four engineering departments: civil, chemical, electrical and computer, or mechanical engineering. EDAL is an interdisciplinary, ocean-oriented facility with its faculty representing the four engineering departments as well as related disciplines. This interdisciplinary orientation permits faculty and students to work on a broad range of socially pertinent and challenging ocean engineering projects. Ocean-associated activities of the mechanical engineering department's Mechanics Research Laboratory focus on engineering mechanics applied to the solution of problems in the marine environment. Recent research funding has been provided by the Office of Naval Research, the National Oceanic and Atmospheric Administration Sea Grant Program, the United States Coast Guard, and other government agencies as well as by the University of New Hampshire's Marine Program.

Persons interested in undergraduate ocean engineering activities are invited to contact any of the four engineering department chairpersons.

**Cooperative Educational Program in Marine Science**

A summer program, entitled "An Introduction to Marine Science," is offered in cooperation with Cornell University.

A general introduction to marine science aimed primarily at undergraduates, the program draws on the backgrounds of more than 25 faculty and nearly as many captains, fishermen, and others whose living is associated with the sea. Prerequisite: at least one full year of college biology. Daily lectures and laboratory and field work are conducted at the Shoals Marine Laboratory on Appledore Island at the Isles of Shoals. No formal examinations; grades are Cr or F (credit or fail). Two sections of a four-week course in Introduction to Marine Science, Zool 774 (5 credits), are taught each summer. Between the sections of this course, advanced courses are offered in Invertebrate Embryology (three weeks, 4 credits), Field Phycology (three weeks, 4 credits), Anatomy of the Gull (one week, 1 credit), Research in Biology (one to five weeks, 1 to 4 credits), and Underwater Research (one to two weeks, 1 to 2 credits). For further information, contact the Marine Program Office, Marine Program Building, UNH, Durham, N.H. 03824.

## Off-Campus Programs

### Consortium (NHCUC) Student Exchange Program

Under the Student Exchange Program of the New Hampshire College and University Council (NHCUC), UNH students may enroll for: one or two courses, one semester of courses, or a full year of coursework at a member school, on a space-available basis. Approval of the UNH adviser and college dean is required. Schools in the NHCUC consortium include: Colby-Sawyer College, Daniel Webster College, Franklin Pierce College, Nathaniel Hawthorne

College, New England College and its Arundel Branch in England (limited enrollment), New Hampshire College, Notre Dame College, Rivier College, St. Anselm's College, UNH, Keene State College, and Plymouth State College. Students will remain as degree candidates and continue to pay normal UNH tuition and fees but must make their own room and board arrangements if they plan to spend a full semester at another Consortium school. For more information and application forms, students should contact George T. Abraham, coordinator for the Student Exchange Program, Liberal Arts Advising Center (Murkland Hall). Associate Professor F. William Forbes (Department of Ancient and Modern Languages and Literatures) is the University's member of the council's Cooperative Academic Programs Committee.

### MVC/UNH Student Exchange Agreement

The purpose of the Merrimack Valley College (MVC)/ UNH student exchange is to allow matriculated undergraduates at either institution to use educational resources which are not available at their home campus but which are available at the host campus and are considered appropriate for their degree programs. The expectation is that the student exchange will be used only when academic reasons or other special circumstances warrant it. UNH undergraduates interested in the student exchange must receive prior approval from George T. Abraham in the Liberal Arts Advising Center, Murkland Hall.

### California Student Exchange Program

The University offers one-semester or full-year exchange programs with California State University at Chico and San Diego State University. Interested students should contact the Dean of Students' Office, Huddleston Hall.

### Foreign Study Programs

The University's Department of Ancient and Modern Languages and Literatures offers opportunities to study in France, Austria, and Spain. For more information, contact the Department of Ancient and Modern Languages and Literatures, Murkland Hall.

There are two University programs to England: through the Department of English, a student can attend a summer program at Cambridge and through the N.H. Consortium, a student can spend a semester or year at Arundel. For the summer program contact the English department. For the Arundel program contact George Abraham in the Advising Center, Murkland Hall.

It is also possible with prior approval to obtain credit from other institutions for foreign study programs. Interested students should contact Robin O. Mellin in the Advising Center, Murkland Hall.

# Associate in Arts in General Studies Degree

The Associate in Arts in General Studies degree gives students an opportunity to: obtain a general, two-year college education, elect career-training coursework in several fields, and earn college credits in supervised work experience with cooperating employers.

The Division of Continuing Education (DCE) designed the program to be equally accessible to both full- and part-time students and, in doing so, assured that a wide range of University credit courses would be available both during the late afternoon and early evening hours and during the daytime.

For full-time A.A. students, cooperative field work can mean alternating semesters of full-time study and full-time employment (with pay) in one of several careers. For part-time students who already hold full-time positions, it can mean an opportunity for new on-the-job experiences for college credit. Each field experience is arranged by a DCE coordinator on an individual basis, depending on student needs and the requirements of the employer.

The Associate in Arts degree can be complete in itself, or it can be a halfway mark toward a bachelor's degree. Credits earned as an A.A. degree candidate are transferable into related bachelor's degree programs at the University of New Hampshire and other colleges and universities.

## Career Options

Within the Associate in Arts degree program, students may elect courses in one or more of the following concentrations:

### Accounting

Accounting is the second largest profession for men in the United States today, and in recent years many women have also taken advantage of the career opportunities in the field. Increasing government regulations—ranging from new tax laws to wage and price controls—require the expertise of a greater number of qualified accountants and auditors. This career option provides students with the degree of specialization required to qualify for responsible jobs in accounting and will aid them in pursuing a more advanced degree at a later time in their careers. Required accounting courses: DCE 462-463, 561, and 562.

### Banking

The career coursework in the banking option meets a need expressed by top-level banking management and associations for employees specifically trained in this field. Combined with the General Education Requirements of the A.A. degree program, these core courses give students the knowledge and skills that top management is continually seeking. Students can supplement money-and-banking courses with electives in management, business law, accounting, and economics to obtain a solid business background. Required banking courses: DCE 440, 441, 533, and 540.

### Craftsmanship (Stringed Instruments)

New Hampshire, which historically has been the home of renowned craftsmen and craftswomen, is currently experiencing a renaissance in the artisan trades. Americans are rediscovering the value of hand-crafted items, and northern New England is fortunate enough to have as natural resources the materials suitable for a number of crafts. Areas of instruction within this unique degree option have been developed to train individuals in the construction and repair of violins and other stringed instruments.

The required craft courses are available only during the summer. Admission to this option is open to individuals from out-of-state, regardless of place of employment. Required craftsmanship courses: DCE 491, 591, 592, and 593 (minimum of 16 credits).

### Criminal Justice

Careers in criminal justice are among the most challenging occupations for men and women today. Careers in criminal justice extend beyond the "police beat" and include, for example, positions in various agencies of law enforcement at the municipal, county, state, and federal levels of government, and in private industry. This career option is offered in cooperation with the Department of Criminal Justice at St. Anselm's College. Required criminal justice courses: DCE 550, 551, and 552, and a choice either of one from DCE 554, Polt 507, or Soc 615, or of two criminal justice courses from St. Anselm's College.

### Insurance

The core courses in the insurance option can assist students who wish to qualify for an agent's and/or broker's license. A.A. graduates who complete the insurance option may find a higher level of job entry and increased promotional opportunities with both large and small insurance firms. This career option may also be supplemented with electives in management to offer a solid educational background for individuals planning to start their own businesses. Required insurance courses: DCE 420, 421, and 422; and at least one from DCE 506, 531, or 532.

### Library Science

Through basic courses in library services, this program prepares paraprofessional librarians to support the professional librarian and to serve the public.

Employment opportunities for paraprofessional librarians exist in public school and college libraries, as well as in specialized libraries maintained by commercial and industrial firms, government agencies, and other organizations and institutions. Required library science courses: DCE 401, 402, and 403; and one from 501, 502, or 503.

### Management

Careers in management exist at many levels, and this career option is designed to assist students in gaining entry and promotional opportunities in the field. The career-training coursework emphasizes and develops the skills needed in management functions. Competent personnel at the assistant managerial level will continue to be needed for business, sales, purchasing, personnel, accounting, and public relations, to name a few. Individuals now planning or running their own businesses will also find the practical nature of this career option quite helpful. Required courses for the *small business management* emphasis: DCE 430; DCE 431 or Admn 411; and two from DCE 411, 432 (or 462), 532, or 534. Required courses for the *manufacturing management* emphasis: DCE 430; DCE 431 or Admn 411; and two from DCE 432 (or 462), 480, or 570. Required courses for the *general management* emphasis, recommended for students without business experience: DCE 430; DCE 431 or Admn 411; and two from DCE 432 (or 462), 530, or 532. Required courses for the *office administration* emphasis: DCE 430; DCE 431 or Admn 411; and eight credits from DCE 432 (or 462), Secr 401-402, or Secr 407-408.

### Merchandising

Careers in merchandising represent a significant segment of New Hampshire's economy, and many functions within the field require specific knowledge and skills. The career-training coursework in merchandising begins with the fundamentals and expands to specific techniques in promotion and advertising, retailing, and credit management. Employment opportunities exist not only in large industries but also in department stores, retail operations, discount stores, supermarkets, mail order operations, and smaller variety stores in the resort areas. Required merchandising courses: DCE 410, 411, 510, and either 512 or 533.

### Quality Control

Personnel working with quality control function in an environment of increasing complexity. Innovations in technology and organization cause frequent changes in their job requirements. Such innovations, when properly understood and applied, make individuals more effective in their work and help them guard against technical obsolescence. The quality control degree option consists of coursework in quality control and management combined with a strong program in liberal arts. Required quality control courses: DCE 480, 580, 581, and 582.

### Real Estate

The career training coursework in the real estate option can help students who wish to qualify for a state license. A.A. graduates who concentrate on the real estate option may often find a higher-level job entry and increased promotional opportunities with both large and small real estate firms. Supplemented with elective courses in management, this option can also offer a solid educational background for individuals planning to establish businesses. Required real estate courses: DCE 425, 426, 525, and 526.

### Secretarial Studies

Secretarial skills will always be in demand in business, industry, government, and education. This career option trains prospective secretaries in the advanced skills necessary to compete successfully. In addition, the general education offered in the Associate in Arts degree program will help secretaries work more efficiently as administrative assistants with competent understanding of current business, social, and cultural problems. A.A. graduates in this career option may enter the secretarial profession or pursue a higher degree at a four-year college of business. This option is offered in cooperation with McIntosh College in Dover. Required secretarial studies courses: Secr 401-402, 407-408, and three related courses from McIntosh College.

### Traffic and Distribution Management

Rapidly rising costs and materials shortages have made product distribution one of the most complicated jobs in the business world today. The problems of energy conservation, cost consciousness, and operational efficiency have created a demand for managers who thoroughly understand the dynamics of physical distribution. This career option was developed to train prospective traffic and distribution managers and to improve the skills of those already employed in the field. Required traffic and distribution management courses: DCE 470, 570, 571, and 431.

## Admission Requirements

For the Associate in Arts degree program, candidates must have a high school diploma or an equivalency certificate and should have demonstrated ability and motivation through secondary school achievement, work experience, and/or military service. Because of the present limited residence hall capacity of the University, this program is available only to commuting New Hampshire residents. The state-residency requirement may be waived for applicants who are full-time employees of a New Hampshire business. Out-of-state applicants, regardless of place of employment, will be accepted for the summer craftsmanship option.

Associate in Arts degree candidates are awarded a minimum of 64 credit hours upon entry into a UNH bachelor's degree program. Degree candidates wishing to continue their studies should consult with their advisers to assure that their planned programs meet the specific requirements for the selected major at the institution awarding the bachelor's degree.

Applications for admission may be obtained from the Office of Admissions, Thompson Hall. After being admitted to the A.A. degree program, candidates will be referred to a permanent adviser in the Office of Academic Advising, Division of Continuing Education.

## Degree Requirements

For degree requirements, see page 16.

## Academic Regulations

Associate in Arts degree candidates are subject to the academic requirements established by the University.

### Pass/Fail

Associate in Arts degree candidates, after completion of a minimum of 16 credits at the University of New Hampshire on a regular graded basis of A to F, may use the pass/fail grading alternative in a maximum of two elective four-credit courses. The pass/fail grading alternative may be used for a maximum of four credits per semester. No pass/fail grading alternative may be used in any of the group requirements, i.e., science-mathematics, arts-humanities, and social sciences. The pass/fail grading alternative may not be used for Engl 401 or for courses in students' declared career option. The minimum passing grade for credit is a D- (0.67). Any grade below this minimum will be considered as a fail.

## Financial Aid

Associate in Arts degree candidates are eligible for the full range of financial aid offered by the University. See the Financial Aid section of this catalog.

## Career-Training Courses

The courses that constitute the core of the career options are drawn from: existing courses of the schools and colleges at the University, courses developed and sponsored by the Division of Continuing Education, and specialized courses offered by cooperating institutions of higher learning.

Because these career-training courses have different "homes," they are listed in different sections in the course descriptions. Courses designated by DCE are listed under Division of Continuing Education; Admn courses are listed under Administration; and Secr courses under Secretarial Studies.

For information on courses offered by cooperating institutions, contact the Division of Continuing Education.

## Advising

Program planning and other advising services are provided by the professional staff of the Division of Continuing Education. Academic advisers are available from 8 a.m. to 5 p.m. daily and during evening hours on an appointment basis.

## Career Option Minors

Bachelor of Arts students may obtain a minor in the DCE career options. Bachelor of Science students may complete the appropriate sequence of courses for a concentration, but not a minor designation. Prior approval from students' advisers and college dean, as well as the DCE coordinator and director, is required. Since these programs are designed primarily for Associate in Arts students, bachelor's students may participate on a space-available basis.

## For More Information

For further information about programs or services, write or visit the Division of Continuing Education, Office of Academic Advising, Brook House, UNH, Durham, N.H. 03824 (603-862-1548).

# Thompson School of Applied Science

**Lewis Roberts, Jr., Director**

The Thompson School of Applied Science (TSAS) offers two-year, technical-level programs leading to an Associate in Applied Science degree. Instruction, a "learning-by-doing" educational approach, trains graduates for employment as technicians, professional assistants, supervisors, and mid-management personnel in industry, organizations, and agencies.

Programs currently offered include: 1) Applied Animal Science, 2) Applied Business Management, 3) Applied Plant Science, 4) Civil Technology, 5) Food Services Management, and 6) Forest Technology.

Thompson School graduates acquire necessary skills and experience to seek satisfactory employment at the end of two years; they also have the option to continue their education at the baccalaureate level. Most colleges accept Thompson School graduates at the junior-year level. Others, including most UNH baccalaureate programs, accept Thompson School graduates as second-semester sophomores.

Thompson School students are eligible for on-campus housing.

## Admission Requirements

Applicants to the Thompson School of Applied Science are considered on the basis of secondary school course selections, academic achievement, class rank, and school recommendations. The secondary school program need not be college preparatory. Rather, emphasis is placed on applicants' motivation and demonstrated interest in their career fields.

All candidates graduating from high school must submit the results of the College Entrance Examination Board Scholastic Aptitude Test. Applicants to the Forest and Civil Technology programs must also have two years of satisfactory work in college preparatory mathematics.

The mission of the Thompson School is to offer applied science degree programs in selected career fields. Students who seek to continue their education in the University's baccalaureate degree programs should realize that transfer consideration is based on applicants' level of achievement and on the availability of spaces in the baccalaureate programs. The University awards approximately 60 percent block transfer credit for TSAS coursework and does not guarantee transfer admission.

In those cases where four-year and Thompson School courses are taught together, TSAS students may enroll in the four-year course if they present academic evidence that the course can be handled successfully, and if they have the written approval of both the TSAS adviser and the instructor of the four-year course. When enrollment in the four-year course is permitted, TSAS students must meet all of the requirements of that course, including regularly scheduled final examinations and attendance to the end of the University academic year.

UNH baccalaureate or associate degree students who take Thompson School 200-level courses should realize that the courses must be taken as audit, and that they carry no graduation credits.

For a Thompson School Catalog and/or more specific information, write or call the director, Thompson School of Applied Science, Barton Hall, Durham, N.H. 03824 (603-862-1025).

# Division of Continuing Education

**Edward J. Durnall, Director**
**Paul A. Dubois,** Assistant Director
**Merna E. Johnson,** Assistant Director: Academic Advisement

The Division of Continuing Education (DCE) provides access to higher education for New Hampshire residents under conditions that permit individuals to participate in University programs appropriate to their changing educational needs. These needs may at times be best satisfied through participation in workshops, seminars, short courses, or certificate programs—at other times by enrollment in credit courses and degree programs.

The faculty of the Divison of Continuing Education is drawn from the teaching staffs of the University, from the faculties of neighboring colleges and universities, and from business, professional, and community leaders.

In addition to the programs listed below, it is possible to complete many of the degree requirements in other areas of study offered by the University through enrollment in credit courses scheduled by DCE each semester.

## Associate in Arts Degree

See page 97.

## Special Student Status

Special students—those who are not formally admitted into a degree program at the University of New Hampshire—may enroll in University credit courses each semester through the Division of Continuing Education.

All special undergraduate students are limited to 11 credits per term unless they obtain written permission from the Dean of Admissions, Thompson Hall. Special graduate students are also subject to enrollment limitations. Contact the Division of Continuing Education for details.

### Undergraduate Courses

Special students must have a high school diploma or its equivalent, or be at least 18 years of age.

### Graduate Courses

Special students must hold a bachelor's degree or equivalent from an approved college or university.

### Prerequisites

All students are responsible for satisfying course prerequisites, if any. Instructors may require students to withdraw from a course if they are not adequately prepared for the level of work.

### Academic Standards

A cumulative grade-point average of 2.00 (C grade) is the minimum acceptable level for undergraduate work in the University. The Division of Continuing Education Executive Committee examines the records of special undergraduate students periodically and may warn academically deficient or potentially deficient students, or may exclude or suspend those who are academically deficient.

## Noncredit Courses

Throughout the year, DCE offers noncredit courses to the community. These courses provide opportunities for individual growth or continuing education for groups and individuals in business, labor, education, government, or the professions.

Professional and career development noncredit courses typically meet one evening a week for about 10 weeks, depending on course objectives. Examples include data processing, business writing, assertiveness training, graphic arts, interior design, skills for teaching, and labor-management relations.

Personal enrichment courses are offered during the day and evening, during the week and on weekends. Examples include physical fitness and recreation, parent-child communication, arts and crafts, local history, current events, personal financial planning, creative writing, and photography.

## Certificate Programs

Certificate programs consist of specifically developed sequences of courses which provide a sound balance of theory, fundamentals, and specialized training. Certificates of achievement awarded by the Division of Continuing

Education have earned professional acceptance as evidence of increased knowledge in basic principles and techniques.

Certificate programs which consist of credit courses include: accounting, banking, craftsmanship (stringed instruments), insurance, library science, management, merchandising, quality control, real estate, and traffic and distribution management.

Noncredit certificate programs include public library techniques (summers only), data processing, hotel/motel management, interior design, graphic arts, and paralegal studies.

## Conferences and Workshops

The Division also conducts conferences, workshops, and seminars, which range from half-day briefings on specific topics to residential institutes lasting several days or weeks. Such programs are offered on topics of community interest and for the continuing education of business, industry, government, and the professions.

Topics can be developed by the Division of Continuing Education or by outside clients who wish to conduct an educational program for their organization. Facilities are arranged through the New England Center for Continuing Education, adjacent to the UNH campus.

## Summer Session

Please see page 104.

## Course Charges

Students who enroll in credit courses through the Division of Continuing Education pay on a per-credit basis, depending on residency status and course level. These course charges are listed in the DCE credit course schedule published before each semester. The course charges for noncredit courses and for conferences, workshops, and institutes vary according to the scope of the individual programs.

## Financial Aid

### Course Charge Grants

Special students (nondegree candidates) who enroll in the Division of Continuing Education may be considered for grants in varying amounts, awarded on the basis of financial need and only for course charges in credit courses and approved noncredit programs offered through DCE. Preference will be given to New Hampshire residents. Application for course-charge assistance must be filed with the Division of Continuing Education at least one month before the start of classes for each term for which assistance is requested. Application forms are available from the DCE office.

### Other Financial Aid

For information on other sources of financial assistance, including Senior Citizen Scholarships, contact the DCE advisers.

## Class Schedule

While students may enroll in morning and afternoon classes through the Division, many courses offered each semester are scheduled in the late afternoon and early evening to accommodate evening students.

All courses offered by the University each semester are open to special students on a space-available basis. However, because UNH degree candidates have first priority in many classes, special students may not be assured space in certain classes until the first class meeting.

## Division Publications

Specific information on course offerings, registration procedures, and academic requirements can be found in individual publications describing each program. For more information, write: Division of Continuing Education, 6 Garrison Avenue, UNH, Durham, N.H. 03824 (603-862-2015).

# Summer Session

**Edward J. Durnall, Director**

The University of New Hampshire offers students the opportunity to continue their studies on a year-round basis through four- and eight-week sessions during the summer months. The summer courses are of the same high quality as those during the regular academic year and require the same level of academic performance.

Summer Session offerings include a full range of undergraduate and graduate credit courses in most of the major academic disciplines. Throughout the summer, classes are scheduled in the morning, afternoon, and evening.

Enrollment in Summer Session classes does not imply admission to degree candidacy.

## Undergraduate Courses

Undergraduate courses are open to college undergraduates, to interested members of the community who have a high school diploma or its equivalent or who are at least 18 years of age, and to high school students completing their junior or senior year (by permission of the director).

## Graduate Courses

Graduate courses are open to graduate students and other individuals with a bachelor's degree or its equivalent from an approved college or university.

## Other Offerings

Other Summer Session offerings include noncredit courses and certificate programs; workshops and seminars for business, industry, and the professions; and residential conferences and academic programs.

## For More Information

A separate summer bulletin is published each year in March and is available from: Division of Continuing Education, 6 Garrison Avenue, University of New Hampshire, Durham, N.H. 03824 (603-862-2015).

# Graduate School

Raymond L. Erickson, Dean and Director of Research
William H. Drew, Associate Dean
Kenneth O. Freer, Assistant Dean

**Master of Arts**
Counseling
Economics
English
  Literature
  Language and Linguistics
  Writing
German
History
Music
Political Science
Psychology
Sociology
Spanish

**Master of Arts in Teaching**
  Elementary Education
  Secondary Education

**Master of Science for Teachers**
Biology
Chemistry
English
Mathematics
Physics
Spanish

**Master of Occupational Education**

**Master of Business Administration**

**Master of Science**
Animal Sciences
Biochemistry
Biology
Botany
Chemical Engineering
Chemistry
Civil Engineering
Communication Disorders
Computer Science
Earth Sciences
  Geology
  Oceanography
Electrical Engineering
Entomology
Genetics
Home Economics
Mathematics
Mechanical Engineering
Microbiology
Music Education
Natural and Environmental Resources
  Forest Resources
  Hydrology
  Resource Economics
  Soil Science
  Resource Administration and Management
  Wildlife Ecology
Physical Education
Physics
Plant Science
Zoology

**Master of Education**
Administration and Supervision
Counseling and Personnel Service
Developmental Disabilities
Early Childhood
Elementary Education
Preservice
Reading
Secondary Education

**Master of Public Administration**
Political Science

**Doctor of Philosophy**
Biochemistry
  Nutrition
Botany
Chemistry
Economics
Engineering
  Signal Processing
  Transport Phenomena
  System Design
  Theory and Applied Mechanics
English
Genetics
History
Mathematics
Mathematics Education
Microbiology
Physics
Plant Science
Psychology
Sociology
Zoology

## Graduate School

The Graduate School offers a wide range of programs leading to the master's degree and a number of programs leading to the Ph.D. degree. Graduate programs have been developed systematically to achieve academic excellence by careful utilization of institutional resources and regional opportunities. A highly qualified graduate faculty supervises programs and establishes the requirements for admission and degrees, which are administered by the dean of the Graduate School.

Most graduate programs are relatively small and permit students to work closely with faculty in the area of specialization. The aim of graduate programs is to offer high-level professional training in their respective disciplines and to provide opportunities for students to learn and practice sound research methods. Graduate students are expected to use fully the available opportunities and to demonstrate the maturity and self-discipline necessary for sound scholarship.

A number of programs and facilities such as the Genetics Program, Jackson Estuarine Laboratory, Ritzman Animal Nutrition Laboratory, Center for Industrial and Institutional Development, Space Science Center, Resource Development Center, Water Resources Research Center, Engineering Design and Analysis Laboratory, Bureau of Educational Research and Testing, and Public Administration Service provide opportunities to engage in interdisciplinary research.

Admission to the Graduate School may be granted to graduates of colleges and universities of approved standing, provided that applicants' undergraduate records are satisfactory. Applicants' race, religion, color, national origin, sex, age, or handicap are not considered in the admissions process. The official application for admission and the Graduate Catalog containing detailed descriptions of graduate programs may be obtained from the dean of the Graduate School, Horton Social Science Center, UNH, Durham, New Hampshire 03824.

### Financial Aid

Graduate assistantships are available in most departments. These involve part-time work in connection with the University's instructional activities. University-sponsored awards, such as tuition scholarships, UNH Fellowships, Martin Luther King awards, and Dissertation Fellowships, are available to qualified students. A number of fellowship programs sponsored by such outside agencies as the National Science Foundation, Department of Health, Education and Welfare, U.S. Office of Education, and the U.S. Public Health Service may be available.

# Description of Courses

## Explanation of Arrangement

The title and arabic number designate the particular course. When two course numbers precede a course title and are connected by a hyphen, the first semester of the course, or its equivalent, is a prerequisite to the second semester. If the course numbers are separated by a comma, qualified students may take the second semester without having had the first.

The notation "Lab" indicates that laboratory sessions are a part of the course in courses that are not designated by title as laboratory courses.

### Prerequisites

Each prerequisite for a course is separated from the other prerequisites by a semicolon; e.g., Prereq: Educ 601; Psyc 635. If permission (of the instructor, department, adviser, or committee) is a prerequisite for all students, it is listed among the prerequisites: e.g., Prereq: Educ 601; Psyc 635; permission. If, on the other hand, permission may be substituted for one or more of the listed prerequisites, it follows the other prerequisites and is separated from them by a slash mark: e.g., Prereq: Educ 601; Psyc 635; / or permission. If permission may be substituted for only one of the prerequisite courses, it is listed with the course for which it may be substituted: e.g., Prereq: Educ 601 or permission; Psyc 635.

### Credits

The number of credits listed is the number of semester credits each course number will count toward graduation (except in the case of variable credit courses). Students must register for the number of credits shown or, if the course is variable credit, must register within the range of credits shown.

Cr/F following the description indicates that no letter grade is given but that the course is graded Credit or Fail.

For up-to-date information about when a course is offered; who teaches the course; the number of recitations, lectures, labs, and such, students are referred to each semester's *Time and Room Schedule*, which carries a complete schedule of course offerings for the semester.

The system of numeric designation is as follows:

**200-299** Courses in Thompson School of Applied Science.*

**300-399** Noncredit courses, e.g., Math 301.

**400-499** Introductory courses not carrying prerequisites and courses generally falling within University and college requirements.

**500-599** Intermediate-level courses for undergraduate credit only.

**600-699** Advanced-level undergraduate courses. Entrance to courses numbered 600 and above normally requires junior standing. (Under some conditions these courses may be taken for graduate credit by nonmajors only.)

**700-799** Advanced-level undergraduate courses. (These courses may be taken for graduate credit.)

**800-899** Courses which carry graduate credit only. (Descriptions will be found in the Graduate School catalog.)

*UNH baccalaureate or associate degree students should realize that 200-level courses must be taken as audit and that they carry no graduation credits.

# Administration (Admn)

**Professors:** Carroll M. Degler, emeritus; Donald C. Marschner, emeritus; Robert F. Barlow, John A. Beckett, Jan E. Clee, Allan R. Cohen, Stephen L. Fink, Herman Gadon, Russell Haley, James O. Horrigan, John J. Korbel, Dwight R. Ladd, Charles B. Warden, Jr., Robin D. Willits, Dwayne E. Wrightsman
**Adjunct Professor:** R. Stephen Jenks
**Associate Professors:** Allan J. Braff, Dale G. Broderick, John M. Burt, Fred R. Kaen, Richard L. Mills, Melvin Sandler, Barry Shore, Linda G. Sprague, William E. Wetzel, Jr.
**Visiting Associate Professor:** Roger Millen
**Assistant Professors:** John Haskell, Michael Jones, Natasha Josefowitz, Michael J. Merenda, Steven L. Obert, Gordon D. Smith, Rita Weathersby
**Instructors:** Michael Kole, Dean R. Plager, Starr F. Schlobohm
**Lecturers:** Ray Belles, Clyde R. Coolidge, Linnea Hirst, David Lloyd, Joseph Michael, Phyllis Schlesinger

**411. BEHAVIOR IN ORGANIZATIONS**
Application of behavioral science concepts at work. Individual behavior, interpersonal relations, small groups, relations between groups—all in the context of a larger organization. Class treated as a real organization; students study own roles, norms, rewards, and leadership, and take responsibility for the effects of their behavior on learning. 4 cr.

**424. QUANTITATIVE ANALYSIS**
Introductory coverage of quantitative methods for managerial decision making; probability, inferential and descriptive statistics, regression, decision theory, use of computer, and linear programming. Sufficient quantitative background provided for all other required undergraduate administration courses. 4 cr.

**425. APPLICATIONS IN QUANTITATIVE ANALYSIS**
The use and misuse of basic analytic skills in administration and economics; methodology and techniques introduced in Admn 424 applied to analysis and interpretation of real-world data. Case studies, student projects, and problems from the media. Prereq: Admn 424 or equivalent. 4 cr.

**502. FINANCIAL ACCOUNTING**
Concepts, procedures, and tools of analysis in selection, quantification, and communication of economic events affecting financial condition, income and cash flows of organizations. (Not open to students who have had DCE 460.) 4 cr.

**503. ACCOUNTING: PLANNING AND CONTROL**
Analytical tools and concepts employed by managers for financial planning and control. Prereq: Admn 502. 4 cr.

**517. SURVEY OF BASIC ACCOUNTING**
Concepts, conventions, and processes in financial and cost accounting. Usefulness and limitations of accounting data in decision making and in analyses of past results. (For students minoring but not majoring in administration. Not open to students who have had DCE 460. No credit for students who have had Admn 502.) 4 cr.

**524. INTRODUCTION TO MANAGEMENT SCIENCE**
Use of quantitative techniques in decision situations. Topics include probability, Bayes' rule, decision trees, linear programming, inventory models, queuing theory, network analysis under uncertainty, simulation, organizational considerations, and computers. Prereq: Admn 424. 4 cr.

**526. INTRODUCTION TO BUSINESS DATA PROCESSING**
Fundamentals of data processing with applications to the functional areas of management. Topics include system design, software, hardware, and applications. Prereq: Admn 424. 4 cr.

**530. PERSONAL FINANCE AND INVESTMENT**
Principles and practices of personal finance and investment. Investments in real estate, stocks and bonds, money-market instruments, savings accounts, and insurance and retirement plans. Personal saving, mortgages, consumer credit, and other means of financing investments. No credit toward a major or minor in administration. 4 cr.

**550. SURVEY OF MARKETING**
Same material as Admn 651, but more general viewpoint. How companies plan products, pricing, advertising, promotion, distribution. Marketing of services. Consumer behavior. Consumerism. Tailored for nonmajors. Prereq: Econ 402 or permission. No credit for students who have had Admn 651. 4 cr.

**602. VALUES IN A MANAGERIAL SOCIETY**
The role and influence of values on management decision making. The conflict between traditional values such as material progress, private property, self-interest, etc., and emerging nations relating to environmentalism, consumerism, worker and product safety, etc. is examined through case discussions and readings. Prereq: Admn major or permission. 4 cr.

**614. ORGANIZATIONAL THEORY**
Characteristics of formal organizations. Theory and concepts useful for analysis and administration of various types: business, educational, medical, social. Case discussions, class exercises, fieldwork. Prereq: Admn 411;/or permission. 4 cr.

**647-648. BUSINESS LAW I, II**
Law of contracts, agency, sales, negotiable instruments, real and personal property, partnership and corporations, with application of the Uniform Commercial Code. Prereq: at least junior status; permission. 4 cr.

**650. OPERATIONS MANAGEMENT**
Analysis of operational problems in the product and service sectors; standards, capacity, inventory, scheduling, and control. Prereq: all Group A courses; /or permission. 4 cr.

**651. MARKETING**
Marketing behavior of the firm as it supplies goods and services to consumers and industrial users. Optimal blending of ingredients in the "marketing mix"; product pricing, promotion, preliminary consumer behavior, marketing research, and selection of distribution channels. Prereq: all Group A courses; /or permission. 4 cr.

**653. FINANCIAL MANAGEMENT**
The firm's uses and sources of funds; working-capital management; capital budgeting; and administration of debt and equity. Prereq: all Group A courses; /or permission. 4 cr.

**661. MANAGERIAL THINKING**
Thinking processes that underlie management and administration; survey of human thought, history of management thought, and prevailing contemporary models of the management process. Suitable background for all upper-division administration courses. 4 cr.

**695-696. INDEPENDENT STUDY**
Individual projects of special interest and benefit. Prerequisite: permission of undergraduate counselor and proposed project supervisor; granted only to students with unusual initiative. 1-12 cr.

**700. BUSINESS POLICY**
Capstone course, interrelating and applying specialized courses; cases of companies, firms, supplemented by economic and other information from published industry, company, and other sources. Prereq: all courses in Group A and Group B. 4 cr.

**702. APPLIED STATISTICS**
Time series and cross-sectioned data; regression analysis; computerized statistical packages. Experimental design; surveys; contingency analysis. Prereq: Admn 801 or basic statistics; permission. 4 cr.

**705. OPERATIONS RESEARCH**
Synthesis and analysis of basic principles and methods of operations research applied to managerial decisions. Mathematical programming, networks, inventory, queuing, sequencing, scheduling, and Markovian models. Prereq: permission. 4 cr.

**706. ADVANCED OPERATIONS RESEARCH**
Analysis and synthesis of complex operations research models. Project is undertaken by all students. Advanced mathematical programming (nonlinear, parametric linear, stochastic, and dynamic), stochastic inventory models, advanced queuing models, and heuristic programs. Prereq: Admn 705 or permission. 4 cr.

**708. MODELING AND SIMULATION**
Modeling: formulation, data preparation, translation, validation, interpretation, and implementation. Discrete simulation models are developed and applied using a special purpose simulation language. Prereq: Admn 801 and 810 or basic probability and statistics; permission. 4 cr.

**712. ORGANIZATIONAL CHANGE**
Process of change in organizations. Change strategies: the change agent's role and relation to the client system. Bases of resistance to change and problems encountered by internal and external change agents. Theoretical reading material, cases, and exercises. Prereq: permission. 4 cr.

**713. INTERPERSONAL AND GROUP DYNAMICS**
Dynamics of small groups through the use of the class itself as an intensive laboratory study group. Students examine their own behavior and its effects on others through the use of the Laboratory Training Group (T-group), and develop conceptual ability and behavioral skills. Readings in group dynamics, interpersonal relations, and sensitivity training. Prereq: permission. Lab fee. 4 cr.

**714. CONFLICT MANAGEMENT**
Conflict among individuals, small groups, and organizations. Analysis of cases, readings, simulations, and roleplays (often using video-tape) develops useful concepts and skills for dealing with conflict. Students examine their own behavior in coping with conflicts within the class. Field project required. Prereq: permission. 4 cr.

**715. THEORY AND PRACTICE OF GROUP LEADERSHIP**
Intensive comparison of and practice in leading task- and process-oriented groups. Student teams design presentations on leadership topics, then study their own leadership-membership issues. Each student also participates in and leads a process-oriented group. Prereq: Admn 713 or equivalent; permission of instructor. 4 cr.

**717. ADVANCED FINANCIAL ACCOUNTING**
Theory and practice as they contribute to the significance and limitations of the financial statements. Prereq: permission. 4 cr.

**718. COST AND MANAGEMENT**
Effective use of cost accounting, cost analysis, and budgeting in planning and controlling operations. Analysis of cost behavior, direct and absorption costing, cost-price-volume relationship, distribution costs, transfer pricing, and capital budgeting analysis. Prereq: permission. 4 cr.

**720. AUDITING**
The attest function, and the responsibility and professional ethics of the independent auditor in our society. Audit concepts, procedures, objectives, and reports. Operational audits, social audits, and management services. Prereq: Admn 717;/or permission. 4 cr.

**722. ACCOUNTING SEMINAR**
Special topics. Prereq: Admn 717 or 718, depending on topics; permission. 4 cr.

**728. STATISTICAL DECISION MAKING**
Probability and statistics applied to decision problems. Bayesian approach to decisions under uncertainty, which explicitly injects prior judgements of decision makers and the consequences of alternative actions. Prereq: Admn 424 or equivalent. 4 cr.

**730. INVESTMENTS ANALYSIS**
Capital market patterns and techniques useful for security analysis. Securities, market institutions, yield series, random walks, intrinsic-value analyses, and portfolio management. Security analysis research projects. Prereq: permission. 4 cr.

**732. EXPLORATION IN ENTREPRENEURIAL MANAGEMENT**
Examination of the management of change and innovation with particular attention to the role of the entrepreneur in the management of new ventures. Characteristic behavioral, organizational, financial, and marketing problems of entrepreneurs and new enterprises. Prereq: permission. 4 cr.

**741. TRANSPORTATION**
Problems of American transportation system. Economic structure of transportation industries; competition among the several modes. Public policy questions: merger, cost-benefit analysis of facilities, for example. Freight transportation; problems of passenger transportation, especially in urban areas. Prereq: permission. 4 cr.

**742. MANAGEMENT INFORMATION SYSTEMS**
Concepts, design ,and implementation of systems to provide information and support for managerial decision making. Use of computers, models, and behavioral factors from the manager's perspective. 4 cr.

**745. INTERNATIONAL BUSINESS**
Issues and problems confronting managers in the international economy. Emphasis on problems of working across national borders rather than on those encountered within the framework of different national economies, cultures, and institutions. For managers working in a multinational enterprise. Prereq: permission. 4 cr.

**747. FEDERAL TAXATION**
Current federal income, estate, and gift taxes and their impact on corporations, partnerships, and individuals. Tax analysis and decision making. 4 cr.

**750. MARKETING MANAGEMENT**
Practical application of theories taught in Admn 651. Planning, organization, and control of marketing activities in large corporations and small businesses; new-product development; pricing policies; selection of channels of distribution; interrelationships between marketing, production, and finance. Sound policy formulation and decision making established through analysis of cases and computer simulation. Prereq: a basic marketing course. 4 cr.

**751. ADVERTISING AND PROMOTION**
Advertising, personal selling, and other promotional tools to help solve marketing problems; advertising as a medium of communication and as a social-cultural force in the Western world. Prereq: Admn 651; /or permission. 4 cr.

**752. MARKETING RESEARCH**
Identification, collection, and analysis of data for the marketing process. Strengths, limitation, environment, and evaluation of research in the marketing process. Prereq: Admn 424 and 651; /or equivalent. 4 cr.

**755. ADVANCED BUSINESS FINANCE**
Development of analytical tools and practical skills for recognizing and solving complex problems of business finance. Working-capital management, capital budgeting, cost of capital, capital structure, and dividend policy. Prereq: Admn 653 or 806. 4 cr.

**756. MANAGEMENT OF FINANCIAL INSTITUTIONS**
How financial institutions manage their sources and uses of funds; impact of external environmental factors upon the operation and performance of financial institutions. Optimal portfolio strategies for commercial banks, savings and loan associations, mutual savings banks, insurance companies, and pension funds. Implications of monetary theory for individual financial institution policies; credit analysis; competition among financial institutions; regulation of financial institutions. Prereq: Admn 653 or 806. 4 cr.

**761. SALES MANAGEMENT**
Principles and methods of successful salesmanship and management of the sales function. Selling experiences in fields of student interest; case studies, sales presentations; oral and written analyses of sales management issues. Prereq: Admn 651. 4 cr.

**762. MARKETING WORKSHOP**
Integrative study of a real marketing situation in a business, nonprofit institution, or government agency. Student teams identify problem, research or collect data, suggest alternate solutions, and submit a recommended course of action. Prereq: Admn 651 or Admn 808; one additional advanced marketing course; permission. 4 cr.

**770. PERSONNEL ADMINISTRATION**
Role of personnel administration and human resource management in achieving goals in "for-profit" and "not-for-profit" organizations. Functions of management; scope, technique, and current issues of personnel administration; organization of personnel activities and staff. How managers relate to personnel administration and interact with personnel administration staff and services. Prereq: permission. 4 cr.

**780. WOMEN IN MANAGEMENT**
Issues faced by women managers in complex organizations; problems associated with role expectations of women as they move into managerial positions traditionally filled by men. Prereq: senior or graduate standing. 4 cr.

**795. INTERNSHIP**
On-the-job skill development through fieldwork in an organization (business, industry, health, public service, etc.). Normally, supervision provided by qualified individual in the organization, with frequent consultation by a faculty sponsor. Written report required. Internships may be part- or full-time, with course credits assigned accordingly. 1-16 cr.

**798. TOPICS IN ADMINISTRATION**
Special topics; may be repeated. Prereq: consent of adviser and instructor. 1-4 cr.

# Aerospace Studies (Aero), Reserve Officers Training Corps

**Professor of Aerospace Studies:** Colonel Donald L. Miller, USAF
**Administrative:** TSgt. Joseph A. Gallagher, SSgt. George C. Giroux, Jr., SSgt. Jeffrey L. Shriver, USAF

Leadership Laboratory is required each semester of all Air Force ROTC students seeking commissions as second lieutenants in the U.S. Air Force upon graduation. Students taking Air Force ROTC courses for credit, but not seeking commissions, need not register for this lab.

**301. LEADERSHIP LABORATORY**
Taken by all AFROTC cadets throughout enrollment in AFROTC. Command and staff leadership experiences in cadet corps. Study of Air Force customs and courtesies; drill and ceremonies; career opportunities and life and work of junior officer. Leadership potential developed in a practical, supervised laboratory. Field trips to Air Force installations. 0 cr.

**415. THE AIR FORCE TODAY I**
Development, mission, and organization of the Air Force as an instrument of the U.S. national defense policy. 1 cr.

**416. THE AIR FORCE TODAY II**
Major Air Force commands; roles of separate operating agencies; organization, systems, and operations of strategic defense; general-purpose aerospace support forces. 1 cr.

**541. THE DEVELOPMENT OF AIR POWER I**
The nature of warfare; development of air power from balloons and dirigibles through World War II. 1 cr.

**542. THE DEVELOPMENT OF AIR POWER II**
Development of air power from post-World War II through the peaceful use of air power in Berlin; the Cuban crisis; research and development; air war in Southeast Asia. 1 cr.

**617. AIR FORCE MANAGEMENT AND LEADERSHIP I**
An integrated management course emphasizing the individual as a manager in the Air Force. Motivation and behavior, leadership, communication, and group dynamics; decision making; planning, organizing, and controlling in a changing environment. 4 cr.

**672. AIR FORCE MANAGEMENT AND LEADERSHIP II**
Organizational and personal values; management of forces in change; organizational power, politics, managerial strategy and tactics; Air Force cases studied. 4 cr.

**681-682. NATIONAL SECURITY FORCES IN CONTEMPORARY AMERICAN SOCIETY I AND II**
A full-year course focused on the armed forces as part of American society, emphasizing civil-military relations in context of U.S. policy formulation and implementation. Attitudes toward the military; socialization processes; role of the professional military leader-manager; requirements for adequate national security forces; political, economic, and social constraints on the national defense structure; impact of technological and international developments on strategic preparedness; the variables involved in the formulation and implementation of national security policy; military justice and administrative law. 3 cr.

# Ancient and Modern Languages and Literatures

**Chairperson:** Grover E. Marshall

**Professors:** John S. Walsh, emeritus; R. Alberto Casás, Warren H. Held, Jr., Louis J. Hudon, Charles H. Leighton
**Associate Professors:** Rose T. Antosiewicz, Richard J. Callan, Lydia L. Crowson, F. William Forbes, Marron C. Fort, Helmut F. Pfanner, Michael J. Rosenbush, John C. Rouman, Jack R. Vrooman
**Assistant Professors:** Roger S. Brown, Barbara T. Cooper, Richard V. Desrosiers, Caren S. Greenberg, Bernadette Komonchak, Grover E. Marshall, James L. Sherman
**Lecturers:** Karl Arndt, Cynthia Brown, Vittorio Felaco, Helen E. Fernald, Robert J. Forbes, Susan E. Gonye, Jennifer A. Piché, Marybeth L. Spain, Carolyn F. Takahara, Barbara H. Wing

## Classics (Clas)

**501. CLASSICAL MYTHOLOGY**
Survey of the myths and sagas of ancient Greece and Rome. No classical preparation necessary. Background course for majors in English, the arts, music, history, classics, etc. One session weekly devoted to related art and music. 4 cr.

**506. INTRODUCTION TO COMPARATIVE AND HISTORICAL LINGUISTICS**
Major language families (primarily Indo-European) and the relationships among languages within a family. Diachronic studies; methods of writing; linguistic change; glottochronology; etymological studies. Some language training and Ling 505 desirable. (Also offered as Ling 506.) 4 cr.

**512. GREEK AND LATIN LITERATURE IN TRANSLATION**
The dimensions of the ancient Greco-Roman civilization from which so much of our contemporary culture derives. For students unprepared to read Greek and Latin. Background course for majors in English, history, Latin, Greek and the modern languages and literatures. 4 cr.

**521, 522. MASTERPIECES OF GRECO-ROMAN CULTURE IN TRANSLATION**
More advanced study of the writings of classical civilizations. For students with some classical preparation. Background course for majors in English, history, Latin, Greek, or the modern languages and literatures. 4 cr.

**595, 596. TOPICS IN CLASSICS**
Introduction and elementary study related to linguistic study of Latin and Greek or relevant to Greco-Roman culture and history. Primarily for students unprepared to read Latin and Greek. Topics: A) Byzantine Heritage; B) Greek and Latin Origins of Medical Terms; C) Greek and Latin Origins of Legal Terms; D) Greek and Latin Origins within the English Language; E) Hellenic Institutions; F) Roman Institutions; G) Classical Backgrounds of Modern Literature; H) Sanskrit; I) Hittite; J) Classical Archaeology. 2 or 4 cr.

**695, 696. SPECIAL STUDIES IN CLASSICS**
Advanced work in classics. Research paper. Not open to freshmen and sophomores. 2 or 4 cr.

## French (Fren)

New students will be assigned to the proper course on the basis of their scores on the College Board Achievement Test. All courses are conducted in French unless otherwise noted. Junior and senior nonmajors may write papers and examinations in English in courses numbered 600 and above. Fren 605-606 is the first course counting toward a major. Students educated in French-speaking countries may not register for courses below the 700 level. Transfer credit will not be given for elementary-level college courses in foreign languages if students have had two or more years of the foreign language in secondary school.

**401-402. ELEMENTARY FRENCH**
For students without previous training in French. Aural comprehension, speaking, writing, reading. Labs. No credit for Fren 401 without Fren 402. (No credit for students who have had two or more years of French in secondary school; however, any such students whose studies of French have been interrupted for a significant period of time should consult the section coordinator about possibly receiving credit.) 4 cr.

**501. INTERMEDIATE FRENCH**
Similar to Fren 503, below, but for students with less preparation. Labs. Prepares for Fren 504. Students receiving credit for Fren 501 may not receive credit for Fren 503. 4 cr.

**503-504. INTERMEDIATE FRENCH**
Intensive reading of complete texts, formal review of grammar, training in oral and written expression of ideas. Labs. Students receiving credit for Fren 503 may not receive credit for Fren 501. 4 cr.

**514. FRENCH GRAMMAR AND SPEECH**
Thorough review of grammar and practice in oral and written expression. Labs. Prereq: Fren 504. Not for major credit. 4 cr.

**516. FRENCH CONVERSATION**
Readings from current French periodicals and from material illustrating various aspects of contemporary France. Emphasis on increasing oral skills through class discussions and reports. Labs. Prereq: Fren 514 or grade of B (3.00) or better in Fren 504. Not for major credit. 4 cr.

**605-606. READINGS IN FRENCH LITERATURE**
Analysis of texts from the 17th century to the present. Prereq: grade of C (2.00) or better in Fren 504. 4 cr.

**620. THE NOVEL OF QUEBEC**
Novel of Quebec as a reflection of a society, its attitudes and development. Readings in French. Taught in French or English as circumstances dictate. Papers and examinations in English for nonmajors. Prereq: Fren 504 or equivalent. 4 cr.

**621. FRENCH PROSE IN TRANSLATION**
Works affecting French thought from the Renaissance to the modern period. Readings, discussion, papers in English. Not for major credit. 4 cr.

**622. FRENCH DRAMA IN TRANSLATION**
Major works of comedy, tragedy, and drama. Molière and Racine to the present day. Readings, discussions, papers in English. Not for major credit. 4 cr.

**685-686. JUNIOR YEAR AT DIJON UNIVERSITY**
Studies at the University of Dijon (France) for juniors who have completed their sophomore year at UNH and have passed with a grade of B or better Fren 605-606 and Fren 514. Students are expected to take French courses in each semester of their freshman and sophomore years. Attendance required at orientation sessions during the second semester of sophomore year. Interested students should consult the director of the program. Prereq (nonmajors): permission. (Not offered for graduate credit.) 32 cr. Cr/F.

**741. FRENCH LITERATURE OF THE MIDDLE AGES**
Epic, lyric poetry, and romance. Prereq: Fren 606. 4 cr. (Not offered every year.)

**742. FRENCH LITERATURE OF THE RENAISSANCE**
Prereq: Fren 606. 4 cr. (Not offered every year.)

**759-760. FRENCH LITERATURE OF THE 17th CENTURY**
Prereq: Fren 606. 4 cr. (Not offered every year.)

**761-762. 18th-CENTURY FRENCH LITERATURE AND THOUGHT**
Prereq: Fren 606. 4 cr. (Not offered every year.)

**767-768. 19th-CENTURY FRENCH LITERATURE**
Romanticism and Realism. Prereq: Fren 606. 4 cr. (Not offered every year.)

**770. INTRODUCTION TO MODERN FRENCH POETRY**
Baudelaire to the present. Prereq: Fren 606. 4 cr. (Not offered every year.)

**781-782. CONTEMPORARY FRENCH NOVEL AND THEATER**
From 1890 to the present. Prereq: Fren 606. 4 cr. (Not offered every year.)

**790. ADVANCED LANGUAGE AND STYLE**
Translation of literary texts, intensive study of principal techniques of style, explication de textes. Prereq: at least two courses in French numbered 741 and above. 4 cr.

**791. METHODS OF FOREIGN LANGUAGE TEACHING—FRENCH**
Interdepartmental course. Objectives, methods, and techniques in teaching Spanish, French, German, and Latin from elementary grades through college. Discussion, demonstration, preparation of instructional materials, microteaching of the language skills. Prereq: permission. Not for major credit. (Same as Germ 791, Latn 791, and Span 791.) 4 cr.

**795, 796. SPECIAL STUDIES IN FRENCH LANGUAGE AND LITERATURE**
Individual guided study of the work of a major author, a genre, or specific topics in literature. Training in bibliography and organization of material. Prereq: permission. 1-4 cr.

**798. SEMINAR IN FRENCH LITERATURE**
Topics chosen by the instructor. May be repeated for credit barring duplication of material. Prereq: Fren 606. 4 cr. (Not offered every year.)

## German (Germ)

New students will be assigned to the proper course on the basis of their scores on the College Board Achievement Test. Transfer credit will not be given for elementary-level college courses in foreign languages if students have had two or more years of the foreign language in secondary school.

**401-402. CONVERSATIONAL GERMAN**
Aural and audio-visual methods. Labs. Previous knowledge of German not required. (No credit for students who have had two or more years of German in secondary school; however, any such students whose studies of German have been interrupted for a significant period of time should consult the section coordinator about possibly receiving credit.) 4 cr.

**403-404. GERMAN FOR READING KNOWLEDGE**
Reading in the natural, physical, and social sciences and the humanities. Previous knowledge of German not required. (No credit for students who have had two or more years of German in secondary school; however, any such students whose studies of German have been interrupted for a significant period of time should consult the section coordinator about possibly receiving credit.) 4 cr.

**407. ACCELERATED GERMAN**
401-402 in one semester. Active use of the German language employing audiovisual techniques. Labs. Previous knowledge of German not required. (No credit for students who have had two or more years of German in secondary school; however, any such students whose studies of German have been interrupted for a significant period of time should consult the section coordinator about possibly receiving credit.) 8 cr.

**501. INTERMEDIATE GERMAN**
Continuation and review of grammar, reading comprehension, and oral-aural practice. For students with high school German who wish to fulfill the liberal arts foreign language requirement and for students with reading knowledge background who need a transition to the oral-track method employed in Germ 504. Instruction in German and English. Students receiving credit for Germ 501 may not receive credit for Germ 503. Labs. 4 cr.

**503-504. INTERMEDIATE GERMAN**
A continuation of Germ 401-402. Instruction in German. Labs. Students receiving credit for Germ 503 may not receive credit for Germ 501. 4 cr.

**525. INTRODUCTION TO GERMAN CULTURE AND CIVILIZATION**
Homogeneous and heterogeneous aspects of the political, social, and cultural life of East Germany, West Germany, Austria, and Switzerland. Conducted in English. This course or its equivalent required of all German majors and strongly recommended for participants in the Salzburg program. 4 cr.

**526. INTRODUCTION TO GERMAN LITERATURE**
Reading and analysis of poems, dramas, and short prose from the works of Goethe, Heine, Rilke, Kafka, Brecht, Dürrenmatt, and others; introduction to theory of literary forms. Conducted in German. This course or its equivalent required of all German majors going on the Salzburg program; prerequisite to upper-level literature courses. 4 cr.

**530. GERMAN CONVERSATION**
Dialogues in German concerning living and studying in Austria and Germany. Necessary for those participating in the Junior Year in Salzburg Program. Prereq: Germ 401-402 and 503; /or equivalent. 2 cr.

**601-602. ADVANCED LANGUAGE AND STYLE**
Essential for all students intending to engage in study or research in a German-speaking country. Essays and oral reports. Required of all German majors; not open to students who will have taken the equivalent courses in Salzburg. 4 cr.

**685-686. JUNIOR YEAR IN SALZBURG**
A program of studies at the University of Salzburg (Austria) for students of colleges and universities in New England who have completed their sophomore year and have passed a minimum of four full courses in German with an average grade of B (3.00) or better and have an overall gradepoint average of C+ (2.33). Students are to take German 530, German Conversation, (2 cr) before going; and German majors are required to take German 526. Students participating are expected to attend a four-week, noncredit orientation seminar in Salzburg before the beginning of the fall semester. Open to all students regardless of major. Interested students should consult the director, Studies Abroad Program. Variable to 32 cr. for UNH degree candidates.

**691, 692. ADVANCED STUDIES IN GERMAN**
A special series of 2-credit courses to develop a knowledge of German language, culture, literature; e.g., A) The Faust Legend; B) Cultural Comparison of the U.S. and Germany; C) Readings in Current Periodicals; D) North Germany: Land and People; E) German Mythology; F) Modern Short Story; G) Germany Tour. 2 cr.

**693, 694. MAJOR GERMAN AUTHORS IN ENGLISH**
Critical reading of major works of one of the following authors. Conducted in English. (German majors read all works in original.) A) Brecht; B) Frisch and Dürrenmatt; C) Other. Barring duplication of material, course may be repeated for credit. 4 cr.

**723. SURVEY OF PRECLASSICAL GERMAN LITERATURE**
German literature from its beginning until the late 18th century. Prereq: Germ 526. 4 cr.

**724. THE AGE OF GOETHE**
Major literary movements between 1770 and 1832. Reading and analysis of selected works. Prereq: Germ 526. 4 cr.

**726. GERMAN CULTURE AND CIVILIZATION**
Historical, social, artistic, and folkloristic developments in German-speaking countries from the beginnings to the present. 4 cr.

**727. GERMAN LITERATURE OF THE 19th CENTURY**
Major literary movements from Goethe's death to the unification of Germany by Bismarck (1832-1872). Reading and analysis of selected works. Prereq: Germ 526. 4 cr.

**728. MODERN GERMAN LITERATURE**
Major literary movements from 1872 to the present. Reading and analysis of selected works. Prereq: Germ 526. 4 cr.

**781. HISTORY AND DEVELOPMENT OF THE GERMAN LANGUAGE**
The changes in sounds, structure, and vocabulary from the earliest record to the present. Required for German majors. 4 cr.

**791. METHODS OF FOREIGN LANGUAGE TEACHING—GERMAN**
Interdepartmental course. Objectives, methods, and techniques in teaching Spanish, French, Latin, and German from elementary grades through college. Discussion, demonstration, preparation of instructional materials, microteaching of the language skills. Prereq: permission. (Same as Fren 791, Latn 791, and Span 791.) 4 cr.

**797, 798. SPECIAL STUDIES IN GERMAN CULTURE AND CIVILIZATION**
Independent investigation; barring duplication of material, may be repeated for credit; presumes a sound background in Germanic studies. 1-4 cr.

## Greek (Grek)

New students will be assigned to the proper course on the basis of their scores on the College Board Achievement Test. Transfer credit will not be given for elementary-level college courses in foreign languages if students have had two or more years of the foreign language in secondary school.

**401-402. ELEMENTARY GREEK**
Grammar, simple composition, and translation. (No credit for students who have had two or more years of Greek in secondary school; however, any such students whose studies of Greek have been interrupted for a significant period of time should consult the section coordinator about possibly receiving credit.) 4 cr.

**503-504. INTERMEDIATE GREEK**
Readings from Xenophon, Plato, Herodotus, Euripides, and the New Testament. Prereq: Grek 402. 4 cr.

**601-602. GREEK PROSE COMPOSITION**
Review of Attic Greek grammar; study of Greek prose style; English to Greek translation. Prereq: permission. 4 cr.

**751, 752. HOMER AND THE ARCHAIC PERIOD**
Readings from the *Iliad*, the *Odyssey*, the Homeric hymns, Hesiod, Pindar, and the lyric poets. Prereq: permission. 4 cr.

**753, 754. ADVANCED STUDIES IN ATHENIAN LITERATURE**
A) Aeschylus; B) Sophocles; C) Euripides; D) Aristophanes; E) Herodotus; F) Thucydides; G) Xenophon; H) Plato; I) Aristotle; J) Lysias; K) Demosthenes; L) Isocrates. Major Attic authors from the Battle of Marathon to the death of Alexander the Great. Prereq: permission. 4 cr.

**795, 796. SPECIAL STUDIES IN GREEK**
A) Pre-Socratic Philosophers; B) Hellenistic Greek Authors; C) Menander; D) Callimachus; E) Apollonius of Rhodes; F) Theocritus; G) Polybius; H) Greek Authors of the Roman Empire; I) Plutarch; J) Septuagint; K) New Testament; L) Greek Church Fathers; M) Byzantine Authors; N) Spoken Greek; O) Advanced Greek Composition; P) Introduction to Classical Scholarship; Q) Greek Epigraphy; R) Greek Dialects; S) Comparative Grammar of Greek and Latin; T) Homer: A Linguistic Analysis; U) Greek Institutions; V) Palaeography and Textual Criticism. Topics selected by instructor and student in conference. Prereq: permission. 2 or 4 cr.

## Italian (Ital)

New students will be assigned to the proper course upon consultation with the section coordinator. Students educated in Italian-speaking countries may not register for courses below the 700 level. Transfer credit will not be given for elementary-level college courses in foreign languages if students have had two or more years of the foreign language in secondary school.

**401-402. ELEMENTARY ITALIAN**
For students without previous training in Italian. Aural comprehension, speaking, writing, reading. Labs. No credit for Ital 401 without Ital 402. (No credit for students who have had two or more years of Italian in secondary school; however, any such students whose studies of Italian have been interrupted for a significant period of time should consult the section coordinator about possibly receiving credit.) 4 cr.

**503-504. INTERMEDIATE ITALIAN**
A complete review of the fundamentals of grammar and syntax. Selected readings as a general introduction to Italian civilization and culture. Labs. 4 cr.

**605. READINGS IN MODERN ITALIAN LITERATURE**
Analysis of 19th and 20th century texts. Discussion and papers in Italian. Prereq: grade of C (2.00) or better in Ital 504. 4 cr.

**606. READINGS IN ITALIAN LITERATURE TO THE 18th CENTURY**
Analysis of texts of the 13th to the 18th century. Discussion and papers in Italian. Prereq: grade of C (2.00) or better in Ital 504. 4 cr.

**795, 796. INDEPENDENT STUDY IN ITALIAN LANGUAGE AND LITERATURE**
Individual guided study. Prereq: permission. 1-4 cr.

## Japanese (Russ)

**415-416. ELEMENTARY JAPANESE**
Elements of Japanese grammar. Oral practice and written drills designed to achieve a mastery of basic grammatical patterns. Reading of graded exercises introducing the student to written Japanese (Hiragana and Katakana) and Chinese characters used in contemporary Japan. Labs. (No credit for students who have had two or more years of Japanese in secondary school; however, any such students whose studies of Japanese have been interrupted for a significant period of time should consult the department chairperson about possibly receiving credit.) 4 cr.

**515-516. INTERMEDIATE JAPANESE**
Review of Japanese grammar. Reading of prose and practice in oral and written expression. Emphasis upon contemporary Japanese. Labs. Prereq: permission or Russ 416 with a grade of C (2.00) or better. 4 cr.

## Latin (Latn)

New students will be assigned to the proper course on the basis of their scores on the College Board Achievement Test. Transfer credit will not be given for elementary-level courses in foreign languages if students have had two or more years of the foreign language in secondary school.

**401-402. ELEMENTARY LATIN**
Elements of grammar, reading of simple prose. Course cannot be counted for major credits. (No credit for students who have had two or more years of Latin in secondary school; however, any such students whose studies of Latin have been interrupted for a significant period of time should consult the section coordinator about possibly receiving credit.) 4 cr.

**501. INTERMEDIATE LATIN**
Similar to Latn 503 (below), but for students continuing from Latn 402 whose preparation does not qualify them for Latn 503. Intensive review of Latin grammar and vocabulary; readings in prose and poetry. Prepares for Latn 504. Completion of 501 fulfills foreign language requirement for B.A. degree. Students receiving credit for Latn 501 may not receive credit for Latn 503. 4 cr.

**503-504. INTERMEDIATE LATIN**
Review. Readings from Cicero, Caesar, Sallust, Livy, Catullus, Horace, Ovid, Plautus, Terence, and Seneca. Prereq: Latn 402 or equivalent. Students receiving credit for Latn 503 may not receive credit for Latn 501. 4 cr.

**601-602. LATIN PROSE COMPOSITION**
Grammar review; study of Latin prose style; English to Latin translation. Prereq: permission. 4 cr.

**751, 752. CICERO AND THE ROMAN REPUBLIC**
Prereq: permission. 4 cr.

**753, 754. ADVANCED STUDIES IN THE LITERATURE OF THE GOLDEN AGE**
A) Lucretius; B) Catullus; C) Caesar; D) Sallust; E) Vergil; F) Horace; G) Tibullus; H) Propertius; I) Ovid; J) Livy. Major Roman authors from the dictatorship of Sulla to the death of Augustus. Prereq: permission. 4 cr.

**755, 756. ADVANCED STUDIES IN THE LITERATURE OF THE SILVER AGE**
A) Seneca the Younger; B) Persius; C) Petronius; D) Lucan; E) Statius; F) Quintillian; G) Martial; H) Juvenal; I) Tacitus; J) Pliny the Younger. Major Roman authors from the reign of Nero to the death of Trajan. Prereq: permission. 4 cr.

**791. METHODS OF FOREIGN LANGUAGE TEACHING—LATIN**
Interdepartmental course. Objectives, methods, and techniques in teaching Spanish, French, German, and Latin from elementary grades through college. Discussion, demonstration, preparation of instructional materials, microteaching of the language skills. Prereq: permission. (Same as Fren 791, Germ 791, and Span 791.) 4 cr.

**795, 796. SPECIAL STUDIES IN LATIN**
A) Minor Authors of the Republic; B) Plautus; C) Terence; D) Minor Authors of the Empire; E) Suetonius; F) Latin Church Fathers; G) Medieval Latin; H) Advanced Latin Composition; I) Introduction to Classical Scholarship; J) Latin Epigraphy; K) Italic Dialects; L) Comparative Grammar of Greek and Latin; M) Roman Law. Topics selected by instructor and student in conference. Prereq: permission. 2 or 4 cr.

## Russian (Russ)

New students will be assigned to the proper course on the basis of their scores on the College Board Achievement Test. Transfer credit will not be given for elementary-level college courses in foreign languages if students have had two or more years of the foreign language in secondary school.

**401-402. ELEMENTARY RUSSIAN**
Oral-aural practice and written drills designed to achieve a mastery of basic grammatical patterns. Labs. Previous knowledge of Russian not required. (No credit for students who have had two or more years of Russian in secondary school; however, any such students whose studies of Russian have been interrupted for a significant period of time should consult the section coordinator about possibly receiving credit.) 4 cr.

**503-504. INTERMEDIATE RUSSIAN**
Continuation of Russ 401-402. Review of Russian grammar, reading of prose, and practice in oral and written expression. Labs. Prereq: Russ 402 or equivalent high school or college course with a grade of C or better. 4 cr.

**505, 506. RUSSIAN FOR CONVERSATION OR READING KNOWLEDGE**
A) Designed to increase fluency in Russian conversation and improve phonetic articulation. B) Designed to increase versatility in reading Russian texts in the natural, physical, and social sciences. Prereq: Russ 401-402; /or permission. 2 cr.

**521. SURVEY OF RUSSIAN LITERATURE IN ENGLISH**
Russian literature of the last 150 years as represented by Pushkin, Gogol, Tolstoy, Dostoevsky, Solzhenitsyn. Readings, discussions, papers in English. 4 cr.

**595, 596. RUSSIAN TOPICS IN ENGLISH**
A series to develop insight and knowledge of Russian culture and literature; e.g., A) Russian Culture and Civilization; B) Soviet Union Culture and Study Tour; C) Satire, Parody, Comedy, and Humor in Russian Literature; D) Soviet Literature; E) Special Topics in Culture and Literature. Knowledge of Russian not required. 2 or 4 cr.

**631-632. ADVANCED RUSSIAN CONVERSATION AND COMPOSITION**
Advanced spoken and written Russian to maintain aural-oral fluency; advanced grammar. Individual conferences. Prereq: Russ 503-504 or equivalent. 4 cr.

**691, 692. ADVANCED STUDIES IN RUSSIAN**
A series of 2- or 4-credit courses on specialized topics to increase knowledge of Russian language, culture, and literature; e.g., A) Readings in Russian Culture and Civilization; B) Russian Drama; C) Russian Comedy and Humor; D) Russian Poetry; E) Russian Short Story; F) Gogol; G) Readings in Current Soviet Periodicals; H) Structure of the Russian Language; I) Special Topics in Russian. Prereq: Russ 503-504; /or permission. 2 or 4 cr.

**693. DOSTOEVSKY**
Evolution of Dostoevsky as artist, thinker, and social critic. Discussion and analysis of major fictional and doctrinal works. Readings, papers, and discussions in English. 4 cr. (Not offered every year.)

**694. TOLSTOY**
Evolution of Tolstoy as artist, thinker, and social critic. Discussion and analysis of major fictional and doctrinal works. Readings, papers, and discussions in English. 4 cr. (Not offered every year.)

**695. CHEKHOV AND OTHERS**
Evolution of Chekhov as artist, thinker, and social critic. Discussion and analysis of major fictional and doctrinal works. Readings, papers, and discussions in English. 4 cr. (Not offered every year.)

**733. PROBLEMS IN STRUCTURE OF THE RUSSIAN LANGUAGE**
Focuses on specific problems in the structure of the Russian language. Barring repetition of material, may be repeated for credit. Prereq: Russ 631-632; /or permission. 2 or 4 cr.

**734. READINGS IN RUSSIAN LITERATURE**
Reading and translation of selected works from Russian literature of the 19th and 20th centuries; samples of prose and poetry; problems of vocabulary building. Prereq: Russ 631-632, or courses in Russ 691, 692; /or permission. 4 cr.

**795, 796. SPECIAL STUDIES IN RUSSIAN LANGUAGE AND LITERATURE**
Selected topics in language, culture, and literature. 1-4 cr.

## Spanish (Span)

New students will be assigned to the proper course on the basis of their scores on the College Board Achievement Test. Transfer credit will not be given for elementary-level college courses in foreign languages if students had two or more years of the foreign language in secondary school. No student educated in a foreign country or for whom Spanish is the native tongue will be permitted to register for any Spanish course numbered 650 or below. All courses conducted in Spanish (or Portuguese) except where noted.

**401-402. ELEMENTARY SPANISH**
For students without previous knowledge of Spanish. Aural-oral practice; fundamental speech patterns; reading and writing to achieve a firm basis for an active command of Spanish. Labs. No credit toward a major. (No credit for students who have had two or more years of Spanish in secondary school; however, any such students whose studies of Spanish have been interrupted for a significant period of time should consult the section coordinator about possibly receiving credit.) 4 cr.

**403-404. ELEMENTARY PORTUGUESE**
For students without previous knowledge of Portuguese. Aural-oral practice; fundamental speech patterns; reading, and writing to achieve a firm basis for an active command of the language. Labs. No credit toward a major. (No credit for students who have had two or more years of Portuguese in secondary school; however, any such students whose studies of Portuguese have been interrupted for a significant period of time should consult the section coordinator about possibly receiving credit.) 4 cr.

**407. ACCELERATED SPANISH**
Span 401-402 in one semester. Study of fundamental speech patterns, reading and writing to achieve a firm basis for active command of Spanish. Labs. Previous knowledge of Spanish is not required. (No credit for students who have had two or more years of Spanish in secondary school; however, any such students whose studies of Spanish have been interrupted for a significant period of time should consult the section coordinator about possibly receiving credit.) 8 cr.

**501. INTERMEDIATE SPANISH**
Similar to Span 503, but for students continuing from Span 402 and whose preparation does not qualify for Span 503. Aural-oral practice; review of basic structure; reading and writing to develop active command of the language. Labs. No credit toward a major. Students with a final grade of B (3.00) or better may register for Span 504, with permission of instructor. Students receiving credit for Span 501 may not receive credit for Span 503. Completion of 501 fulfills foreign language requirement for the B.A. degree. 4 cr.

**503-504. INTERMEDIATE SPANISH**
Complete literary texts of intellectual worth; review of language structure; oral and written expression of ideas. Discussion and papers in Spanish. Labs. Open by placement examination and to students who have passed Span 402 with a C (2.00). Students receiving an A (4.00) in Span 504 may take courses numbered 750 and above with the permission of the department. No credit toward the major for 503. Students receiving credit for Span 503 may not receive credit for Span 501. 4 cr.

**507-508. INTERMEDIATE PORTUGUESE**
Conversation and composition based on readings in contemporary Portuguese and Brazilian literature, especially theater, which is closest to conventional language. A traditional grammar text supplements reading. Labs. 4 cr.

**525. SPANISH CIVILIZATION AND CULTURE**
Historical, geographical, and artistic expressions of Spanish civilization which have formed the character of contemporary Spanish culture. Readings, slides, films, tapes, and records. Conducted in English. Majors must take either 525 or 526, but both may not be counted for major credit. 4 cr.

**526. SPANISH-AMERICAN CIVILIZATION AND CULTURE**
Significant historical, geographical, and artistic expressions of pre-Colombian and Spanish-American civilization. Readings, slides, films, tapes, records. Conducted in English. Majors must take either 525 or 526, but both may not be counted for major credit. 4 cr.

**601. SPANISH PHONETICS**
Practical application of fundamental phonetic theory to spoken Spanish. Required of Spanish majors. 2 cr.

**621. SPANISH AND PORTUGUESE LITERATURE IN TRANSLATION**
Major works by principal authors, such as: Camoens, Cervantes, Lope de Vega, Calderón, Eça de Queiroz, Unamuno, Ortega y Gasset, Garcia Lorca, Casona, etc. Readings, discussions, papers in English. Does not count for Spanish major. 4 cr.

**622. SPANISH-AMERICAN AND BRAZILIAN LITERATURE IN TRANSLATION**
Major works by principal authors, such as: Inca Garcilaso, Diaz del Castillo, Machado de Assis, Borges, Asturias, Neruda, E. Verissimo, Fuentes, Leñero, Guimarães Rosa, and Jorge Amado. Readings, discussion, papers in English. Does not count toward Spanish major. 4 cr.

**631, 632. ADVANCED SPANISH CONVERSATION AND COMPOSITION**
To maintain and perfect written and spoken Spanish through intensive classroom work, individual conferences, and laboratory sessions. Prereq: Span 504 or equivalent. 4 cr.

**One course from Span 651, 652, 653, 654 (or an equivalent course) is prerequisite to all higher literature courses in Spanish.**

**651, 652. INTRODUCTION TO SPANISH LITERATURE AND THOUGHT**
Reading and analysis of major works within the historical, cultural, and social background of the Iberian peninsula. Papers, discussion, and examinations in Spanish. Prereq: Span 631-632. May be taken concurrently with Span 632 with permission of adviser. 4 cr.

**653, 654. INTRODUCTION TO SPANISH-AMERICAN LITERATURE AND THOUGHT**
Reading and analysis of major works within the historical, cultural, and social background of the New World. Papers, discussion, and examinations in Spanish. Prereq: Span 631-632. May be taken concurrently with Span 632 with permission of adviser. 4 cr.

**685, 686. JUNIOR YEAR ABROAD**
Program of studies at a Spanish or Spanish-American university for juniors who have completed sophomore year at UNH and passed Span 503-504 or equivalent with grade of B (3.00) or better. Students required to take noncredit orientation meetings during the semester prior to departure. Interested students should consult with the program directors. Variable to 16 cr.

**691, 692. READINGS IN CURRENT PERIODICALS**
Advanced practice in reading, speaking, and writing, based on current events in contemporary periodicals of the Spanish-speaking world. Co- or prereq: Span 632 or equivalent. May be repeated. 2 cr.

**752. DRAMA AND POETRY OF THE SIGLO DE ORO**
Social and historical background of the baroque period. Representative plays of Lope de Vega, Tirso de Molina, Calderón; lyric poetry of Lope, Góngora, and Quevedo; prose developments. Prereq: Span 652 or equivalent. 4 cr. (Not offered every year.)

**754. CERVANTES**
Cervantes' literary art. Selections from the major works. The Quijote, its originality and significance; its antecedents; its religious, philosophical, and sociological aspects; and its artistic structure. Prereq: Span 652 or 654 or equivalent. 4 cr. (Not offered every year.)

**755. LITERATURE OF THE 19th CENTURY**
Larra, Espronceda, Bécquer, Pérez Galdós, and Blasco Ibanez. Romanticism, realism, and naturalism. Prereq: Span 652 or 654 or equivalent. 4 cr. (Not offered every year.)

**757. THEATER AND POETRY OF THE 20th CENTURY**
The Generation of 1898 and Modernismo: Lorca, Casona, Buero Vallejo, Sastre, Salinas, Guillén, and Miguel Hernández. Prereq: Span 652, 654, or equivalent. 4 cr.

**758. SPANISH PROSE OF THE 20th CENTURY**
Novels, short stories, and essays. Unamuno, Baroja, Menendez Pidal, Ortega y Gasset, Julián Marías, Aranguren, Perez de Ayala, Gironella, and Cela; survey of contemporary prose. Prereq: Span 652, 654, or equivalent. 4 cr. (Not offered every year.)

**760. UNAMUNO AND ORTEGA Y GASSET**
Philosophical ideology and literary content of major contributions of Miguel de Unamuno and José Ortega y Gasset. Prereq: Span 652, 654, or equivalent;/or permission. 4 cr. (Not offered every year.)

**771. SPANISH-AMERICAN DRAMA**
From pre-Hispanic origins to the present, modern playwrights of Mexico and Puerto Rico. Prereq: Span 652, 654, or equivalent. 4 cr. (Not offered every year.)

**772. SPANISH-AMERICAN NOVEL**
Development from romanticism to the present; contemporary trends and techniques. Prereq: Span 652, 654, or equivalent. 4 cr. (Not offered every year.)

**773. SPANISH-AMERICAN SHORT STORY**
Representative authors; stress on 20th century. Principles of interpretation. Prereq: Span 652, 654, or equivalent. 4 cr. (Not offered every year.)

**774. MAJOR SPANISH-AMERICAN AUTHORS**
Works and lives of selected writers; pertinent historical circumstances. Prereq: Span 652, 654, or equivalent. 4 cr. (Not offered every year.)

**791. METHODS OF FOREIGN LANGUAGE TEACHING—SPANISH**
Interdepartmental course. Objectives, methods, and techniques in teaching Spanish, French, German, and Latin from elementary grades through college. Discussion, demonstration, preparation of instructional materials, microteaching of the language skills. Prereq: permission. (Same as Fren 791, Germ 791, and Latn 791.) 4 cr.

**795, 796. SPECIAL STUDIES IN SPANISH LANGUAGE AND LITERATURE**
A) The History of the Spanish Language; B) Medieval Spanish Literature; C) Spanish Literature of the Renaissance; D) Spanish Literature of the Golden Age; E) Spanish Literature of the 18th and 19th Centuries; F) Spanish Literature of the 20th Century (1898-1936); G) Contemporary Spanish Literature; H) Spanish-American Literature of the 16th and 17th Centuries; I) Spanish-American Literature of the 18th and 19th Centuries; J) Spanish-American Literature of the 20th Century; K) Contemporary Spanish-American Literature; L) Structural and Applied Linguistics; M) Spanish Literary Criticism; N) Spanish-American Essay; O) Latin America; P) Catalan; Q) Spanish Poetry; R) Spanish-American Poetry; S) Galdós; T) Archetype Latin American Literature; U) Special Teaching Problems; V) Spanish Civilization and Culture; W) Latin American Civilization and Culture; X) Borges; Y) Spanish Theater; Z) Spanish for Graduates (two-semester course must be taken in sequence): AA) Hispanic Minorities of the United States: BB) Portuguese. Guided study with training in bibliography and organization of material. Topics selected by instructor and student in conference. Prereq: permission of the major supervisor. 2 or 4 cr.

# Animal Sciences (AnSc)

**Chairperson:** Winthrop C. Skoglund

**Professors:** Fred E. Allen, emeritus; C. Hilton Boynton, emeritus; Harry A. Keener, emeritus; Kenneth S. Morrow, emeritus; Richard C. Ringrose, emeritus; Richard Warren, emeritus; Walter M. Collins, William R. Dunlop, James B. Holter, Winthrop C. Skoglund, Samuel C. Smith, Richard G. Strout
**Associate Professors:** Alan C. Corbett, emeritus; Thomas P. Fairchild, Gerald L. Smith, Larry L. Stackhouse
**Assistant Professors:** William C. Condon, Ginny W. Darr, Walter E. Hylton, Frank J. Repka, Charles Schwab, James W. Smith
**Instructor:** Robert E. Bray
**Lecturers:** Dwight E. Barney, Janet C. Briggs, Amy S. Dickens, Bernard W. Gaiser, Jr., Elizabeth C. Smith

**400. ANIMALS, FOOD, AND MAN**
Nutrition and food science; biological, social, political, economic, and historical significance of food. Animal food products. S. Smith, staff. 4 cr.

**401. INTRODUCTION TO THE ANIMAL SCIENCES**
Development, economic importance, and problems of the livestock industry; commercially important classes of farm animals; and the place of the biological sciences in animal agriculture. Mr. Skoglund, staff. Lab. 4 cr.

**402. HORSEMANSHIP**
For beginning, intermediate, and advanced riders, riding instruction on University-owned horses. Limited number of students may stable their horses at the University. $80 fee. Ms. Briggs, staff. 2 cr.

**404. INTRODUCTION TO LIGHT HORSE SCIENCE**
Breeds, feeding, genetics, stable management, diseases, and other aspects of the light horse science field. Mr. Bray, staff. Lab. 4 cr.

**501. ANIMAL ANATOMY AND PHYSIOLOGY**
General anatomy and physiology of domestic animals and birds. Mr. Hylton. 4 cr.

**502. FUNDAMENTALS OF ANIMAL HEALTH**
Principles of disease mechanisms: causes, body reactions, and preventive medicine. Prerequisite for other AnSc disease courses. Mr. Hylton. 2 cr.

**503. ABATTOIR MANAGEMENT**
Licensing requirements, sanitation, inspection facilities, and use of the slaughterhouse; field trips. Prereq: permission. Mr. G.L. Smith, Mr. Barney. Lab. 2 cr.

**504. MEAT AND ITS PRODUCTS**
Slaughtering, cutting, and identification of beef, lamb, pork, and poultry; field trips. Mr. G.L. Smith. Lab. 4 cr.

**506. PRINCIPLES OF NUTRITION**
Fundamental principles underlying the nutrition of humans and animals; functions of nutrients in the maintenance, growth, and production of the animal body, and the metabolic disorders resulting from their deficiency; digestion, absorption, intermediary metabolism, and excretion of individual nutrients. Mr. Schwab and staff. (Also offered as HEc 506.) Lab. 4 cr.

**507. THE SCIENTIFIC APPROACH TO EQUINE DISCIPLINE**
Physiological development, control, and education; bitting, longeing, and collection. Prereq: AnSc 402 or equivalent; permission. Ms. Briggs. Lab. 2 cr.

**508, 509. ANIMAL MANAGEMENT CLINIC**
Instruction in field situations for AnSc and pre-vet majors; experience in animal management techniques and procedures. 508, Dairy and Livestock; 509, Light Horses. Prereq: permission. Mr. Barney, Mr. Bray, and staff. May be repeated. 2 cr. Cr/F.

**601-602. ANIMAL SELECTION**
Principles of selection based on production performance, pedigree, and type evaluation. 601-1. Livestock, Mr. Barney; 602-2. Dairy, Mr. Fairchild. 602-3. Light Horses, Ms. Briggs. Prereq: permission. May be repeated. Lab. 2 cr.

**603. APPLIED ANIMAL NUTRITION**
Application of scientific principles of nutrition to feed formulation and feeding systems for poultry and livestock. Mr. G.L. Smith, staff. Lab. 4 cr.

**606. EQUINE DISEASES AND PARASITES**
Common veterinary problems of horses, including infectious diseases, colic, parasites, and lameness. Prereq: AnSc 502. Mr. Hylton. 2 cr.

**607. SMALL ANIMAL DISEASES**
Common diseases in companion animals; emphasis on canine/feline medicine. Mr. Stackhouse, Mr. Moore. Prereq: AnSc 502. 2 cr.

**609. LIVESTOCK DISEASES**
Common veterinary problems of dairy and beef cattle, sheep, and swine. Prereq: AnSc 502. Mr. Hylton. 2 cr.

**614. DISEASES AND PARASITES OF WILDLIFE**
Diseases and parasites of fishes, birds, and game and fur-bearing animals. Control of diseases by management practices; effect of pesticides on wildlife; relationship of wildlife diseases to human health; autopsy techniques, handling of specimens, and use of state lab facilities. Prereq: permission. Mr. Strout, staff. Lab. 4 cr.

**616. EQUINE PODOLOGY**
Structure and function of the appendicular skeleton; conformation of each segment of normal and abnormal limbs. Staff. Lab. 4 cr. (Not offered every year.)

**617. LIVESTOCK CLINIC**
Disease principles applied to clinical cases in the University herds and flocks; practical treatments and methods. Should be taken concurrently with AnSc 609. Prereq: AnSc 502 and permission. Mr. Hylton. 2 cr.

**618. LIGHT HORSE CLINIC**
Disease principles applied to clinical cases in the University herd. Should be taken concurrently with AnSc 606. Prereq: AnSc 502 and permission. Mr. Hylton. 2 cr.

**651-652. MANAGEMENT OF DOMESTIC ANIMALS**
Economic and management factors of the production of various species. Students may select any or all of the following specialized areas: 651-1. Light Horses, Mr. Gaiser; 651-2. Dairy, Mr. Fairchild; 652-3. Livestock, Mr. G.L. Smith; 652-4. Poultry, Mr. Skoglund. Prereq: permission. Lab. 4 cr.

**653-654. PRINCIPLES OF TEACHING EQUITATION**
Teaching techniques and procedures, with emphasis on dressage; opportunity to teach riding theory and techniques to other students under supervision of instructor. Must be taken for two semesters. Prereq: AnSc 402, 507, and 651-1; permission. $80 fee. Ms. Briggs. Lab. 4 cr.

**697. ANIMAL SCIENCE SEMINAR**
Survey: recent literature and research. Staff. 2 cr.

**701. PHYSIOLOGY OF REPRODUCTION**
Physiology, embryology, endocrinology, reproduction, and lactation in domestic animals. Mr. Condon. Lab. 4 cr.

**702. EXPERIMENTAL ENDOCRINOLOGY OF REPRODUCTION AND LACTATION**
Hormonal control of the estrous cycle; pregnancy and mammary gland growth and lactation; current experimental data. Prereq: AnSc 701. Mr. Condon. Lab. 4 cr.

**704. PRINCIPLES OF PATHOBIOLOGY**
Principles of disease processes; reactivity of the diseased cell, tissue, and organ. Prereq: AnSc 501, 502, and a 600-level disease course; /or permission. Mr. Stackhouse. 3 cr.

**709. BIOCHEMISTRY OF NUTRITION**
Intermediary metabolism of nutrients and energy; metabolism transport mechanisms; biological oxidations; interrelationships of carbohydrate, fat, and protein metabolism; obesity; control of hunger and appetite. Prereq: college course in biochemistry. Staff. Lab. (Also offered as HEc 709.) 4 cr.

**710. RUMINANT NUTRITION**
Feeding and management of dairy animals; calf feeding, raising young stock, feeding for economical milk production. Mr. Holter. Lab. 4 cr.

**711. COMPARATIVE ANIMAL GENETICS**
How heredity affects domestic animals, poultry, other mammals, and fish; emphasis on the organism and population. Quantitative inheritance; principles of selection; disease resistance; statistical and experimental techniques. Prereq: 4 cr. of genetics; /or permission. Mr. Collins. Lab. 4 cr.

**712. ANIMAL BREEDING AND IMPROVEMENT**
Population genetics and selection, with emphasis on the application of these principles to effect genetic improvement in dairy cattle, livestock, and horses. Prereq: AnSc 711. Mr. Fairchild. Lab. 4 cr. (Not offered every year.)

**714. INTRODUCTION TO ELECTRON MICROSCOPY**
Principles and methods used in preparing and examining vertebrate, invertebrate, microbial, viral, plant, and physical specimens in the electron microscope. Theory and application of fixation and embedding procedures, ultramicrotomy, operation of the electron microscope, and special techniques such as autoradiography and ultrastructural histochemistry. Prereq: permission; general chemistry. Ms. Darr. Lab. 4 cr.

**795-796. INVESTIGATIONS IN DAIRY, LIVESTOCK, POULTRY**
Problems in: 1) Genetics—G.L. Smith, Collins, Fairchild; 2) Nutrition—G.L. Smith, Schwab, Holter; 3) Management—G.L. Smith, Skoglund; 4) Diseases—Dunlop, Hylton, Strout, S.C. Smith, Stackhouse, Darr, Moore; 5) Products—G.L. Smith; 6) Light Horsemanship—Briggs, Gaiser, Bray; 7) Physiology—Condon. Prereq: permission. May be repeated. 1-4 cr.

# Anthropology

(See Sociology and Anthropology)

# The Arts (Arts)

**Chairperson:** Arthur E. Balderacchi

**Professors:** George R. Thomas, emeritus; Sigmund M. Abeles, John W. Hatch, John L. Laurent, Melvin J. Zabarsky
**Associate Professors:** Arthur E. Balderacchi, F. Conley Harris, Richard D. Merritt, Winifred C. Shaw, Daniel L. Valenza
**Assistant Professors:** Morton C. Abromson, David S. Andrew, Bruno Civitico, Margot Clark, Michael McConnell, Maryse P. Searls, Mara R. Witzling
**Adjunct Assistant Professor:** Susan C. Faxon
**Visiting Lecturer:** Lou Kohl-Morgan

Courses in the Department of the Arts are designed to support two degree programs: B.A. and B.F.A.

## Two-Dimensional Courses

**All courses elective by permission of the Department of the Arts.**

**432. DRAWING I**
Lab. 4 cr.

**532. DRAWING II**
Prereq: Arts 432. Lab. 4 cr.

**533. DRAWING III**
Prereq: Arts 532. Lab. 4 cr.

**534. DRAWING IV**
Prereq: Arts 533. Lab. 4 cr.

**The above courses are sequential drawing experiences, from the basic elements of line, form, space, etc., in various drawing media, concentrating on still-life and figure, and leading to conceptual exercises with emphasis on the individual's drawing development.**

**455. ARCHITECTURAL DRAFTING AND DESIGN**
Study of architectural symbols and interpretation of architectural plans. Problems in architectural design. Lab. 4 cr.

**536. INTRODUCTORY PRINTMAKING**
Graphic arts in a range of media. Prereq: Arts 532. Lab. 4 cr.

**542. OIL PAINTING I**
Prereq: Arts 432. Lab. 4 cr.

**547. OIL PAINTING II**
Prereq: Arts 542 or 544. Lab. 4 cr.

**548. OIL PAINTING III**
Prereq: Arts 547. Lab. 4 cr.

**643. OIL PAINTING IV**
Prereq: Arts 548 or 645. Lab. 4 cr.

**644. OIL PAINTING V**
Prereq: Arts 643. Lab. 4 cr.

**The above courses are sequential painting experiences. Aspects of composition, color, and conceptualization.**

**544. WATER MEDIA I**
Transparent and opaque water color. Prereq: Arts 432. Lab. 4 cr.

**551. PHOTOGRAPHY I**
Theory and practice of black-and-white creative photography. Recommended that students provide their own cameras. Lab. 4 cr.

**598. SOPHOMORE SEMINAR**
Encourages experimentation by integrating verbal and plastic understandings through readings, discussions, studio work. Field trips. Prereq: 2 art history courses and 2 studio arts courses. 4 cr.

**636, 637. PRINTMAKING WORKSHOP**
Prereq: Arts 536. Lab. 4 cr.

**645. WATER MEDIA II**
Continuation of Arts 544; introduction to other water-based media. Prereq: Arts 547. Lab. 4 cr.

**651. PHOTOGRAPHY II**
Theory and practice of creative color photography. Camera and laboratory manipulative methods in black and white and/or color. Recommended that students provide their own cameras. Prereq: Arts 551. Lab. 4 cr.

**695. SPECIAL PROBLEMS IN THE VISUAL ARTS**
See description under Three-Dimensional Courses.

**751. PHOTOGRAPHY III**
Application of new materials and methods. Recommended that students provide their own cameras. Prereq: Arts 651. Lab. 4 cr.

**796. INDEPENDENT STUDY IN THE VISUAL ARTS**
A) Photography; B) Sculpture; C) Drawing; D) Painting; E) Graphics; F) Water Media; G) Architectural Design; H) Curatorial Assistant; I) Art History; J) Ceramics; K) Jewelry and Metalsmithing; L) Weaving; M) Wood Design. Open to highly qualified juniors and seniors. Prereq: permission of department chairperson and supervising faculty member or members. May be repeated to a total of 8 cr. 1-8 cr.

**798. SEMINAR/SENIOR THESIS**
Readings and discussions oriented toward the intellectual premises of art. Culminates in mounting an exhibition of the student's work. Required of all students in the B.F.A. program. Other advanced students may elect with instructor's permission. A year-long course; an "IA" grade (continuing course) will be given at the end of the first semester. Lab. 8 cr.

## Three-Dimensional Courses

**All courses elective by permission of the Department of the Arts.**

**501. CERAMICS I**
Principles and materials of ceramics. Prereq: Arts 432. Lab. 4 cr.

**513. JEWELRY AND METALSMITHING I**
Principles and materials of jewelry and metalsmithing. Lab. 4 cr.

**519. WEAVING I**
Principles and materials of weaving. Lab. (A section of this course is offered for 2 credits for occupational therapy majors only; no prerequisite.) 4 cr.

**525. WOODWORKING**
Principles and materials of woodworking. Prereq: ARts 432. Lab. (A section of this course is offered for occupational therapy majors only; no prerequisite.) 4 cr.

**567. SCULPTURE I**
Principles and materials of sculpture. Prereq: Arts 432. Lab. 4 cr.

**598. SOPHOMORE SEMINAR**
See description under Two-Dimensional Courses.

**601, 602. CERAMICS II AND III**
Studio research into technical and aesthetic solutions of contemporary problems. Prereq: Arts 501. Lab. 4 cr.

**613, 614. JEWELRY AND METALSMITHING II AND III**
Design and construction of small-scale objects. Prereq: Arts 513. Lab. 4 cr.

**619, 620. WEAVING II AND III**
Four- and eight-harness weaves; double weave and 3-D fiber constructions. Prereq: Arts 519. Lab. 4 cr.

**625, 626. WOOD/FURNITURE DESIGN**
Studio design and construction of major furniture forms. Prereq: Arts 525. Lab. 4 cr.

**668, 669. SCULPTURE II AND III**
Studio research into technical and aesthetic solutions of contemporary problems. Prereq: Arts 567. Lab. 4 cr.

**695. SPECIAL PROBLEMS IN THE VISUAL ARTS**
Topics and prerequisites to be announced before preregistration. May be repeated with permission of the instructor. Lab. 4 cr.

**701. CLAY AND GLAZE FORMULATION**
Prereq: Arts 601 and 602. Lab. 4 cr.

**725. WOOD/ENVIRONMENTAL DESIGN**
Topic announced before preregistration. Prereq: Arts 625, 626. Lab. 4 cr.

**767. CASTING**
Study with cast bronze and aluminum sculpture. Prereq: two 600-level studio courses in the 3-D discipline. Lab. 4 cr.

**768. SCULPTURE IV**
Advanced studio research. Individual criticism. Prereq: Arts 668, 669, 767. Arranged. 4 cr.

**See also Arts 796 and 798.**

## History of Art Courses

**Exemption from prerequisites by permission of instructor.**

**431. VISUAL STUDIES**
Appreciation and understanding of the visual arts. Works from variety of periods; emphasis on style, formal analysis, methods and materials of production. For freshmen and sophomores; open to juniors and seniors by permission. 4 cr.

**480. ART OF THE ANCIENT WORLD**
The chief and representative monuments in architecture, sculpture, and painting from Paleolithic times to the late Roman empire. The history of art from a broadly humanistic perspective with investigation of works such as Stonehenge, the pyramids at Giza, Mesopotamian votive figures, the Parthenon and its sculptures, and illusionistic Roman frescoes at Pompeii. No prerequisites. 4 cr.

**481. ART OF THE MIDDLE AGES**
The chief and representative monuments in architecture, sculpture, and painting from early Christian times to the Gothic era. The history of art from a broadly humanistic perspective with investigation of works such as the Constantinian basilicas, Byzantine mosaics, the *Lindisfarne Gospels*, the portal sculpture of Autun, and Chartres cathedral. 4 cr.

**482. ART OF THE AGE OF HUMANISM**
The chief and representative monuments in architecture, sculpture, and painting from the early Florentine Renaissance to the courtly era of Louis XVI. The history of art from a broadly humanistic perspective with investigation of works such as Masaccio's frescoes, Michelangelo's *David*, the Ghent Altar, the basilica of St. Peter's, Rembrandt's self-portraits, and the Georgian house in Portsmouth. 4 cr.

**483. ART OF THE MODERN WORLD**
The chief and representative monuments in painting, sculpture, and architecture from the Age of Reason to the present. The history of art from a broadly humanistic perspective with investigation of works such as David's revolutionary paintings, Monet's *Water Lillies*, Piscasso's *Guernica*, Pollock's drip paintings, Sullivan's skyscrapers, and Rodin's *Gates of Hell*. 4 cr.

**484. GREAT ARTISTS AND MONUMENTS**
A concentrated investigation of a small number of important works selected from the entire history of art. The history of art from a broadly humanistic perspective with investigation of such varied works as Michelangelo's *David* and van Gogh's *Starry Night*. 4 cr.

**485. STUDIES IN ARCHITECTURE**
A survey of the chief and representative buildings from the entire history of architecture. Analysis of buildings with regard to structure, form, and symbolic content, concentrating on major works such as the pyramids, the Roman Pantheon, the Gothic cathedral, the Renaissance palace, the Baroque church, and the modern skyscraper. 4 cr.

**486. STUDIES IN SCULPTURE**
A survey of selected representative works from the entire history of sculpture. Analysis of the structure, materials, form, and symbolic content of relief and free-standing sculpture, including works such as the Egyptian pharaonic portraits, the sculptural program of the Athenian Parthenon, the portal of Autun, Michelangelo's *Slaves*, Bernini's mythological figures, Rodin's *Thinker*, and Oldenburg's *Soft Fan*. 4 cr.

**575. GREEK AND ROMAN ART**
Painting, sculpture, and architecture of ancient Greece and Rome from approximately 1500 B.C. to 315 A.D. Prereq: two 400-level art history courses. 4 cr.

**577. EARLY MEDIEVAL ART**
The development of Christian art to include early Christian art, Byzantine art in the East and West, Coptic art, and Christian art in northern Europe to the 11th century. Architecture, painting, sculpture, and the minor arts. Prereq: two 400-level art history courses. 4 cr.

**578. ROMANESQUE AND GOTHIC ART**
Art in western Europe from the 11th to the 15th century: architecture, sculpture, painting, and the minor arts. Prereq: two 400-level art history courses. 4 cr.

**580. NORTHERN RENAISSANCE ART**
Painting, sculpture, and graphic arts in France, Germany, Austria, and the Lowlands from the 14th through the 16th century. Prereq: two 400-level art history courses. 4 cr.

**582. ITALIAN RENAISSANCE ART I**
Painting, sculpture, and architecture of the trecento and quattrocento; Giotto, Masaccio, Piero della Francesca, Alberti, Brunelleschi, Ghiberti, Donatello, Mantegna, and Bellini. Prereq: two 400-level art history courses. 4 cr.

**583. ITALIAN RENAISSANCE ART II**
Continuation of Arts 582. Emphasis on the major figures of the High Renaissance: Bramante, Leonardo, Raphael, Michelangelo, and Titian. Prereq: two 400-level art history courses. 4 cr.

**585. BAROQUE ART IN SOUTHERN EUROPE**
Painting, sculpture, and architecture in Italy in the 17th and 18th centuries; 17th-century painting in Spain. Prereq: two 400-level art history courses. 4 cr.

**586. BAROQUE ART IN NORTHERN EUROPE**
Painting, sculpture, and architecture in France in the 17th and 18th centuries; 17th-century painting in the Lowlands; English and Bavarian architecture. Prereq: two 400-level art history courses. 4 cr.

**588. 19th-CENTURY PAINTING AND SCULPTURE**
Principal developments from David to Cezanne. Prereq: two 400-level art history courses. 4 cr.

**589. 20th-CENTURY PAINTING AND SCULPTURE**
Principal developments from the 1890s to the 1940s. Prereq: two 400-level art history courses. 4 cr.

**593. AMERICAN ART**
A chronological survey of painting and sculpture in the United States from the colonial period to the present. Prereq: two 400-level art history courses. 4 cr.

**594. 17th- AND 18th-CENTURY AMERICAN ARCHITECTURE**
Chief colonial architectural styles and monuments; their relation to European antecedents. Field trips. Prereq: two 400-level art history courses. 4 cr.

**595. EARLY MODERN ARCHITECTURE: REVOLUTION TO WORLD WAR I**
Chief styles and monuments of American and European architecture from the "visionaries" (Ledoux, Latrobe, Jefferson) to the birth of the skyscraper and "nonhistorical" architecture. Unique American contribution to modern architectural thought. Field trips. Prereq: two 400-level art history courses. 4 cr.

**596. CONTEMPORARY ARCHITECTURE: THE BUILDINGS OF OUR TIMES**
Chief styles and monuments of American and European architecture from Frank Lloyd Wright and the International Style to the present. Field trips. Prereq: two 400-level art history courses. 4 cr.

**597. INTRODUCTION TO NON-WESTERN ART**
Origins of art in prehistory. Evolution of pictorial and sculptural images in primitive cultures and the Orient; concentration on the development of pictorial art in China and Japan. 4 cr. (Not offered every year.)

**689. ART SINCE 1945**
Tentative history of the very contemporary painting and sculpture of the New York-to-Paris art scene. Prereq: Arts 589. 4 cr.

**695. SPECIAL PROBLEMS IN THE VISUAL ARTS**
See description under Three-Dimensional Courses.

**696. METHODS OF ART HISTORY**
Essential bibliography and the methodology of research; the variety of approaches to art historical scholarship. Readings, discussion, and projects in connoissuership, iconography, historiography, and museology. Prereq (for non-art history majors): permission. 4 cr.

**698. SEMINAR IN ART HISTORY**
Topics and prerequisites to be announced before preregistration. May be repeated with permission of instructor. 4 cr.

**699. MUSEUM STUDIES**
Introduction to museum practices. History of museums: their purposes, organization, interpretation, policies, and procedures. Use of University Art Galleries, visits to other museums, lecturers. Prereq: two courses in art history and permission. 4 cr.

**See Arts 796.**

## Art Education Courses

**All courses elective by permission of the Department of the Arts.**

**791. ART EDUCATION**
Philosophy, objectives, and methods of the teaching of the visual arts, grades K-12. Lab. 4 cr.

**See also Arts 796.**

# Biochemistry (Bchm)

**Chairperson:** James A. Stewart

**Professors:** Stanley R. Shimer, emeritus; Donald M. Green, Edward J. Herbst, Miyoshi Ikawa, Gerald L. Klippenstein, Samuel C. Smith, Arthur E. Teeri
**Associate Professor:** James A. Stewart

**402. BIOCHEMISTRY AND MAN**
Of interest to all students; examines the biochemical principles man uses to modify his environment and existence, and the biochemical basis of disease treatment and prevention, nutrition, industrial processing, food manufacturing, and pollution and its control. Mr. Green. Prereq: secondary-school-level general chemistry. 4 cr.

**501. BIOLOGICAL CHEMISTRY**
Includes an introduction to organic chemistry. Prereq: one semester of chemistry or equivalent. Students receiving credit for Bchm 501 may not receive credit for Bchm 601. Mr. Teeri. Lab. 4 cr.

**601. GENERAL BIOCHEMISTRY**
General principles. Prereq: organic chemistry. Students receiving credit for Bchm 601 may not receive credit for Bchm 501. Mr. Ikawa. Lab. 4 cr.

**656. PHYSIOLOGICAL CHEMISTRY AND NUTRITION**
Mammalian biochemistry with emphasis on the human. Lab study includes procedures basic to chemical methods of medical diagnosis. Prereq: organic chemistry. Mr. Teeri. Lab. 4 cr.

**699. SENIOR THESIS**
Research in biochemistry for senior majors. 2 cr.

**702. COMPARATIVE MARINE BIOCHEMISTRY**
Nutrition, metabolism, and composition of marine organisms and relation to phylogeny; marine natural products. Mr. Ikawa. Prereq: Bchm 601 or equivalent. 3 cr. (Alternate years; offered 1979-80.)

**721. NEUROCHEMISTRY**
Biochemistry of the nervous system; metabolism and alterations of normal brain chemistry by drugs, chemicals, nutrition, memory, and learning; pathological changes. Mr. Stewart. Prereq: a biochemistry course. 3 cr. (Alternate years; offered 1980-81.)

**751-752. PRINCIPLES OF BIOCHEMISTRY**
Fundamental biochemistry; chemistry, metabolism, and biological function of nucleic acids, proteins, carbohydrates, and lipids. Prereq: organic chemistry or permission. Mr. Klippenstein and Mr. Stewart. Lab. 4 cr.

**760. ENZYME CHEMISTRY**
Structure, properties, and function of enzymes; kinetics and mechanisms of enzyme-catalyzed reactions; purification, characterization, and assay of enzymes. Mr. Klippenstein. Prereq: Bchm 601 or 751. Lab. 4 cr. (Alternate years; offered 1980-81.)

**770. BIOCHEMICAL GENETICS**
Mechanisms of storage, replication, transmission, transcription, recombination, mutation, and expression of genetic information by cells and viruses. Mr. Green. Prerq: Bchm 751 or permission. Lab. 4 cr. (Alternate years; offered 1979-80.)

**781. THE NUCLEIC ACIDS**
Chemistry and metabolism of nucleic acids; molecular structures, purification and separation, biosynthesis, and biological functions. Mr. Herbst. Prereq: organic chemistry; biochemistry. 3 cr.

**795, 796. INVESTIGATIONS IN BIOCHEMISTRY**
Prereq: permission. Subject matter and hours to be arranged. 2 cr.

# Biology (Biol)

See additional course descriptions under Animal Sciences, Biochemistry, Botany, Entomology, Forest Resources, Microbiology, Plant Science, and Zoology.

**401. HUMAN BIOLOGY**
Elementary study of structure, function, and development of all systems of the body. No credit toward major or minor. Cannot be taken for credit after Zool 507-508. 4 cr.

**402. MAN AND HIS ENVIRONMENT**
Basic interrelationships between organisms and populations and their environments; ecosystems; man's modification of his environment and its consequences. No credit toward a major or minor. Students with credit for Biol 541 cannot receive credit for Biol 402. 4 cr.

**403. THE LIVING WORLD**
General survey of plant and animal kingdoms; elementary principles of heredity, evolution, and ecology. No credit toward a major or minor. 4 cr.

**409. HUMAN REPRODUCTIVE BIOLOGY**
Aspects of human sexuality from anatomical, physiological, and other viewpoints. No credit toward a major or minor. 4 cr.

**420. MAN, NATURE, AND DISEASE**
Ecology of human disease; role of disease in history; biological, social, and economic problems involved in eradication and control. Particular attention to diseases that still account for serious sickness and mortality in overpopulated, underdeveloped countries. No credit toward a major or minor. 4 cr.

**541. GENERAL ECOLOGY**
Interrelationships between organisms and their physical environment; populations, communities, the ecosystem, energy flow. Prereq: introductory chemistry; Bot 411; Zool 412;/or equivalent. 4 cr.

**543. FIELD ECOLOGY**
Consideration of ecological principles by inquiry in natural habitats and in the laboratory. Prereq: Math 425, statistics, or equivalent; present or prior enrollment in Biol 541; permission. Lab. 2 cr.

**791. PROBLEMS IN THE TEACHING OF HIGH SCHOOL BIOLOGY**
Objectives and methods; selection and organization of materials, preparation of visual aids and other projects; use of field trips. Prereq: two years of biological science; permission. 4 cr.

# Botany and Plant Pathology (Bot)

**Chairperson:** A. Linn Bogle

**Professors:** Stuart Dunn, emeritus; Charlotte G. Nast, emerita; Arthur C. Mathieson, Avery E. Rich, Richard W. Schreiber
**Adjunct Professors:** John M. Kingsbury, Alex L. Shigo
**Associate Professors:** Alan L. Baker, Robert O. Blanchard, A. Linn Bogle, William E. MacHardy
**Assistant Professors:** Garrett E. Crow, Leland S. Jahnke, Russell S. Kinerson, Subhash C. Minocha
**Adjunct Assistant Professor:** Walter C. Shortle

**411. GENERAL BOTANY**
Introduction to plant biology. Evolution of structure and function in the plant kingdom. Equivalent to Bot 412. Cannot be taken for credit if credit received for Bot 412. Mr. Schreiber. Lab. 4 cr.

**412. INTRODUCTORY BOTANY**
All groups of plants; growth, development, and environmental responses. Equivalent to Bot 411. Cannot be taken for credit if credit received for Bot 411. Mr. Jahnke. Lab. 4 cr.

**503. THE PLANT WORLD**
Survey of the plant kingdom from an evolutionary point of view; from the bacteria to the flowering plants, tracing the evolution of form, structure, and function in, and the interrelationship of, the major plant groups. Prereq: Bot 411 or 412, or equivalent with permission. Mr. Bogle. Lab. 4 cr.

**525. INTRODUCTION TO MARINE BOTANY**
Life history, classification, and ecology of micro- and macroscopic marine plants, including phytoplankton, seaweed, and salt marsh plants, and the interactions between man and marine plant communities. Occasional Saturday morning field trips. Prereq: Bot 411 or 412; a semester of biology; /or permission. Staff. Lab. 4 cr. (Summer Session only.)

**566. SYSTEMATIC BOTANY**
Scientific basis of plant taxonomy and the identification and classification of native trees, shrubs, and wild flowers. Prereq: one semester of biological science. Mr. Crow. Lab. 4 cr.

**606. PLANT PHYSIOLOGY**
Structure and function in higher plants: water relations, metabolism, growth, and development. Prereq: Bot 411, 412, 503, or PlSc 421; and one year of chemistry; /or permission. Mr. Minocha. Mr. Pollard. Lab. 4 cr.

**658. PLANT ANATOMY**
Anatomy of vascular plants, emphasizing structure and development of basic cell and tissue types, and of the major plant organs. Prereq: Bot 411 or 412 or 503. Mr. Bogle. Lab. 4 cr. (Alternate years, offered 1980-81.)

**666. SUMMER FLORA OF NEW HAMPSHIRE**
Study of the flora of New Hampshire with an in-depth look at the major vegetation types. Fieldwork will include trips to study flora of forests, dunes, salt marshes, swamps, bogs, lakes, ponds, streams, and alpine. Prereq: basic botany or permission. Staff. 4 cr. (Summer Session only.)

**717. GENERAL LIMNOLOGY**
Special relationships of freshwater organisms to the chemical, physical, and biological aspects of their environment; factors regulating their distribution; and the primary and secondary productivity of lakes. Prereq: Biol 541 or equivalent. Mr. Baker, Mr. Haney. 4 cr.

**719. FIELD LIMNOLOGY**
Principles of freshwater ecology, from a variety of habitats; the methods used to study lakes and interpret data. Occasional Saturday field trips. Prereq: prior or simultaneous enrollment in Bot 717; permission. Mr. Baker and Mr. Haney. Lab. 4 cr.

**720. REPRODUCTIVE AND DEVELOPMENTAL PHYSIOLOGY**
Recent advances in the physiology of flowering, fertilization, and seed formation; mechanisms of synthesis, transport and storage of reserve foods in seeds, tubers, etc.; role of plant hormones in agriculture; physiological aspects of plant improvement. Prereq: Bot 606 or permission. Mr. Minocha. 4 cr. (Alternate years; offered 1980-81.)

**721. THE MICROSCOPIC ALGAE**
Survey of phytoplankton and periphyton in local marine and freshwater habitats. Identification, systematics, and evolution. Class and individual collection trips. Prereq: Bot 411, 412, or 503. Mr. Baker. Lab. 4 cr.

**722. MARINE PHYCOLOGY**
Identification, classification, ecology, and life histories of the major groups of marine algae, particularly the benthonic marine algae of New England. Periodic field trips. Prereq: Bot 411, 412, or 503. Mr. Mathieson. Lab. 4 cr. (Alternate years; offered 1979-80.)

**723. MARINE ALGAL ECOLOGY**
Distribution, abundance, and growth of marine plants in relation to their environment. Scheduled field trips and an independent research project are required. Prereq: Bot 722 or Zool 715 or permission. Mr. Mathieson. Lab. 4 cr. (Alternate years; offered 1980-81.)

**724. FRESHWATER ALGAL ECOLOGY**
Survey of freshwater algal habitats; physiological explanation of advanced population models. Individual experimental projects. Prereq: Bot 717 or 721 or permission. Mr. Baker. 4 cr.

**727. ALGAL PHYSIOLOGY**
A survey of major topics in the physiology and biochemistry of marine and freshwater algae including: nutrition, metabolic pathways, reproductive physiology, storage and extracellular products, cell inclusions, growth and development. Prereq: plant physiology and introductory biochemistry or permission. Mr. Jahnke. 2 cr. (Alternate years; offered 1979-80.)

**729. ALGAL PHYSIOLOGY LABORATORY**
Useful laboratory techniques in studying the physiology of freshwater and marine algae. Experiments in nutrition, metabolism, pigment and enzyme analysis. Small research project required. Prereq: concurrent registration in Bot 727 and permission. Mr. Jahnke. 2 cr. (Alternate years: offered 1979-80.)

**730. MORPHOGENESIS**
Principles of differentiation; internal and external factors in cellular and organismic development. Prereq: Bot 606 or permission. Mr. Minocha. 4 cr. (Alternate years; offered 1979-80.)

**732. CELL BIOLOGY**
Structure, behavior, and development of cells; the cellular basis of heredity. Prereq: one year of biological science and chemistry. Mr. Schreiber. 4 cr.

**741. ECOSYSTEM ANALYSIS**
Ecosystem structure and function; energy flow and biochemical cycles. Computer simulations of natural ecosystems. Prereq: Biol 541 or permission. Mr. Kinerson. Lab. 4 cr.

**742. PHYSIOLOGICAL ECOLOGY**
Physiological responses of plants to the physical environment; photosynthesis, water relations, mass and energy flow. Prereq: Bot 606 or permission. Mr. Kinerson. Lab. 4 cr.

**747. AQUATIC HIGHER PLANTS**
Flowering plants and fern relatives found in and about bodies of water in the northeastern United States; extensive field and herbarium work, preparation techniques, and collections. Prereq: Bot 566. Mr. Crow. Lab. 4 cr. (Alternate years; offered 1980-81.)

**751. PLANT PATHOLOGY**
Nature, symptomatology, etiology, classification, and control of important plant diseases. Prereq: Bot 411 or 412, or equivalent. Mr. Rich. Lab. 4 cr.

**752. MYCOLOGY**
Parasitic and saprophytic fungi; growth, reproduction, and identification; preparation of pure cultures. Prereq: Bot 411 or 412, or equivalent. Mr. Blanchard. Lab. 4 cr. (Alternate years; offered 1980-81.)

**753. FOREST PATHOLOGY**
Principles, etiology, epidemiology, and control of forest and shade tree diseases. Prereq: Bot 411 or 412, or equivalent. Mr. Blanchard. Lab. 4 cr.

**754. PRINCIPLES OF PLANT DISEASE CONTROL**
Epidemiology of plant diseases and relationships to cultural practices; resistant varieties; biological control and chemical control. Crop loss assessment; disease forecasting and disease pest management. Lab. Prereq: Bot 751 or 753. Mr. MacHardy. 4 cr. (Alternate years; offered 1979-80.)

**761. PLANT GEOGRAPHY**
Distribution of plants, a consideration of vegetation types and floras, and problems of endemism with emphasis on North America; major influential factors such as geologic, climatic, edaphic, and biotic. Major contributions from Humboldt to the present time. Prereq: Bot 566 or permission. Mr. Crow. 4 cr. (Alternate years; offered 1980-81.)

**762. MORPHOLOGY OF THE VASCULAR PLANTS**
Comparative form and structure of the major living and extinct groups; evolutionary modifications of the vegetative and reproductive organs, and the basic life history pattern. Prereq: Bot 503. Mr. Bogle. Lab. 4 cr. (Alternate years; offered 1979-80.)

**764. MICROTECHNIQUE**
Methods of preserving cell and tissue structure, embedding, sectioning, and staining plant tissues, and an introduction to microscopy. Prereq: permission. Mr. Bogle. Lab. 4 cr. (Alternate years; offered 1980-81.)

**795-796. INVESTIGATIONS IN:**
A) Systematic Botany; B) Plant Physiology; C) Plant Pathology; D) Plant Anatomy; E) Plant Ecology; F) Mycology; G) Cell Biology; H) Phycology; I) Botanical Teaching; J) Morphology; K) Cell Physiology; L) Scientific Writing. Individual projects under faculty guidance. Elective only with permission. 2-4 cr.

# Chemical Engineering (ChE)

**Chairperson:** Stephen S. T. Fan

**Professors:** Irvin Lavine, emeritus; Oswald T. Zimmerman, emeritus; Stephen S. T. Fan
**Associate Professors:** Virendra K. Mathur, Gail D. Ulrich
**Assistant Professors:** Ihab H. Farag, Donald C. Sundberg

**410. SURVEY OF CURRENT ENERGY AND POLLUTION ISSUES**
Energy supply in this country and the world; conventional fuel reserves: coal, oil, natural gas; alternative sources: nuclear, solar, geothermal, etc. Forecasts and strategies to meet needs. Environmental pollution, sources, and economic and environmental impacts. Methods for pollution control. Regulatory standards for environmental protection. Prereq: good background in high school chemistry. 4 cr.

**501. INTRODUCTION TO CHEMICAL ENGINEERING I**
Overview of the profession. Systems of units; material balances and chemical reactions; gas laws; phase phenomena. 3 cr.

**502. INTRODUCTION TO CHEMICAL ENGINEERING II**
Energy and material balances for simple and complex systems with and without chemical reactions. 3 cr.

**601. FLUID MECHANICS AND UNIT OPERATIONS**
Continuity, momentum, and energy equations; laminar and turbulent flow in pipes; rheology. Applications to flow in porous media, filtration, and fluidization. Lab. 4 cr.

**602. HEAT TRANSFER AND UNIT OPERATIONS**
Thermal properties of materials, steady-state and transient conduction and convection; radiation; applications to heat exchangers and process equipment. Lab. 4 cr.

**603. APPLIED MATHEMATICS FOR CHEMICAL ENGINEERS**
Mathematical modeling and analysis of chemical engineering problems. Analytical methods for first- and second-order differential equations; numerical solutions; series solutions; Bessel function; Laplace transforms; matrix algebra. Interpretation and solution of partial differential equations. Prereq: knowledge of FORTRAN programming. Lab. 4 cr.

**604. CHEMICAL ENGINEERING THERMODYNAMICS**
Volumetric and phase behavior of ideal and real gases and liquids; cycles; steady-flow processes; chemical equilibrium. Lab. 4 cr.

**605. MASS TRANSFER AND STAGEWISE OPERATIONS**
Diffusion in gases, liquids, and solids; design and analysis of distillation, absorption, adsorption, extraction, and other stagewise equipment and operations. Lab. 4 cr.

**606. CHEMICAL ENGINEERING KINETICS**
Use of laboratory data to design commercial reactors. Continuous, batch, plug-flow, and stirred-tank reactors for homogeneous and catalytic multiphase reactions. Lab. 4 cr.

**608. CHEMICAL ENGINEERING DESIGN**
Introduction to cost engineering. Application of acquired skills to design of chemical processes. Individual, major design project required. Lab. 4 cr.

**609. FUNDAMENTALS OF AIR POLLUTION AND ITS CONTROL**
Sources, pollutant transfer, and effects. Regulatory, administrative, legal, and social aspects; engineering control. 4 cr.

**695. CHEMICAL ENGINEERING PROJECT**
Independent research problems carried out under faculty supervision. 2-4 cr.

**696. INDEPENDENT STUDY**
Prereq: permission of the adviser and department chairperson; granted only to students having superior scholastic achievement. 1-4 cr.

**701. HIGH POLYMERS**
Principles and practice of industrial methods of polymerization and processing. Physical and chemical testing of various polymers. Lab. 4 cr.

**705. NATURAL AND SYNTHETIC FOSSIL FUELS**
Study of U.S. and foreign reserves of coal, oil, and natural gas. Petroleum processing and refining. Coal, oil shale, and tar sand. Gasification and liquefaction of coal. Lab. 4 cr.

**712. INTRODUCTION TO NUCLEAR ENGINEERING**
Development of nuclear reactors; basic binding-energy physics; radioactivity; elements of nuclear reactor theory; engineering problems of heat transfer, fluid flow, materials selection, and shielding; environmental impacts. 4 cr.

**751. PROCESS SIMULATION AND OPTIMIZATION**
Techniques for computer-aided analysis of chemical processing systems. Development of mathematical models to describe process behavior. Application of optimization techniques. Prereq: a knowledge of FORTRAN programming. Lab. 4 cr.

**752. PROCESS DYNAMICS AND CONTROL**
Dynamic behavior of chemical engineering processes described by differential equations; feedback control concepts and techniques; stability and analysis. Lab. 4 cr.

**772. PHYSICOCHEMICAL PROCESSES FOR WATER AND AIR QUALITY CONTROL**
Origin and characterization of pollutants. Controls, including filtration, sedimentation, coagulation and flocculation, absorption and adsorption. Applied fluid mechanics, mass transfer, and kinetics. Thermal pollution, chemical treatment, oil spills on water, and aeration. Lab. 4 cr.

# Chemistry (Chem)

**Chairperson:** Clarence L. Grant

**Professors:** Albert F. Daggett, emeritus; Helmut M. Haendler, emeritus; Alexander R. Amell, Kenneth K. Andersen, Clarence L. Grant, Paul R. Jones, James D. Morrison, Charles W. Owens, Frank L. Pilar, Albert K. Sawyer, J. John Uebel, James H. Weber, Charles M. Wheeler
**Associate Professors:** N. Dennis Chasteen, Colin D. Hubbard
**Assistant Professors:** W. Rudolf Seitz, Gary R. Weisman, Edward H. Wong

***401-402. GENERAL CHEMISTRY**
Elementary, nonmathematical, broad view of chemistry, including laboratory work. For students who do not intend to take any other chemistry courses, students whose major department requires this course, and those interested in satisfying a science requirement. Cannot be used as a prerequisite for other chemistry courses without the permission of the chemistry department. Lab. 4 cr.

*Students may receive credit for only one course from 401, 403, and 405, and for only one course from 402, 404.

***403-404. GENERAL CHEMISTRY**
Fundamental laws and concepts; nonmetals, metals, and their compounds. Theoretical principles illustrated by lecture-demonstrations; applications of chemistry in the professions. For students who plan to take further chemistry courses. Lab. 4 cr.

***405. INTRODUCTORY CHEMISTRY**
Basic principles; atomic structure, bonding, equilibria, and thermodynamics. First course for chemistry majors. Prereq: one year of high school chemistry. Cannot be taken for credit if credit received for Chem 403-404. Lab. 4 cr.

**406. QUANTITATIVE ANALYSIS**
Studies of pollution, environmental problems, and the more traditional professional work in chemistry rely heavily on a sound knowledge of analytical chemistry. Principles and techniques of chemical analysis, normally followed by a more advanced course in instrumental methods of chemical analysis. (Students must take 407 concurrently.) Prereq: Chem 404 or 405. 3 cr.

**407. QUANTITATIVE ANALYSIS LABORATORY**
Techniques of weighing, titration, and gravimetric and volumetric analysis; instrumental methods of analysis. Treatment of data, error analysis, and calculations of results. (Must be taken concurrently with 406.) 2 cr.

**517. QUANTITATIVE ANALYSIS**
For students planning careers in medicine, dentistry, plant and animal science, nursing, oceanography, and environmental science. Gravimetric, volumetric, and instrumental methods. Prereq: Chem 404 or 405. (Students must take 518 concurrently.) 3 cr.

**518. QUANTITATIVE ANALYSIS LABORATORY**
Gravimetric and volumetric determination; separations; and selected instrumental methods such as pH and potentiometry, spectrophotometry, atomic absorption, and gas chromatography. (Students must take 517 concurrently.) 2 cr.

**545. ORGANIC CHEMISTRY**
Introductory study of carbon compounds for those who desire a brief terminal course. Prereq: Chem 404 or 405. Elective for medical technology, nursing, and majors in botany. (546 must be taken concurrently.) Students receiving credit for Chem 545 may not receive credit for Chem 402, 547-548, or 651-652. 3 cr.

**546. ORGANIC CHEMISTRY LABORATORY**
(Must be taken concurrently with 545.) 2 cr.

*Students may receive credit for only one course from 401, 403, and 405, and for only one course from 402, 404.

**547-548. ORGANIC CHEMISTRY**
Principal classes of organic compounds, aliphatic and aromatic; class reactions and structural theory. Intended primarily for chemistry and biochemistry majors. Prereq: Chem 404 or 405 or permission. (549-550 must be taken concurrently.) Students receiving credit for Chem 547-548 may not receive credit for either Chem 545 or 651-652. 3 cr.

**549-550. ORGANIC CHEMISTRY LABORATORY**
(Must be taken concurrently with 547-548.) 2 cr.

**651-652. ORGANIC CHEMISTRY**
Principal classes of organic compounds, aliphatic and aromatic; class reactions and structural theory. Intended primarily for prehealing arts, biological science, and health science students. Prereq: Chem 404 or 405 or permission. (653-654 must be taken concurrently.) Students receiving credit for Chem 651-652 may not receive credit for either Chem 545 or 547-548. 3 cr.

**653-654. ORGANIC CHEMISTRY LABORATORY**
(Must be taken concurrently with 651-652.) 2 cr.

**663. INTRODUCTORY RADIOCHEMICAL TECHNIQUES**
Techniques and laboratory practice in the use of apparatus in many fields of science employing radiochemical operations. Prereq: general inorganic chemistry and general physics. Lab. 4 cr. (Not offered every year.)

**683-684. PHYSICAL CHEMISTRY I, II**
The properties of gases, liquids, and solids; thermochemistry and thermodynamics; solutions, chemical equilibria, reaction rates, conductance, and electromotive force. Prereq: Math 426; pre- or coreq: Phys 407 or 402. Undergraduates must register for 685-686 concurrently. 3 cr.

**685-686. PHYSICAL CHEMISTRY LABORATORY**
Measurement of thermodynamic properties, chemical kinetics, and methods of determining the structure of matter. Prereq: Math 426; pre- or coreq: Phys 407 or 402. Undergraduates must register for 683-684 concurrently. 2 cr.

**696. INDEPENDENT STUDY**
For exceptional students. Individual reading, writing, or laboratory work carried out under the tutelage of a faculty member. The course may be used to replace specific required courses in chemistry. Prereq: approval of the adviser and department chairperson. Credits to be arranged.

**697. CHEMICAL LITERATURE**
The chemistry library as a research tool. Prereq: Chem 548 or 652. 1 cr.

**698. SEMINAR**
Student reports on topics of interest. Prereq: Chem 548 or 652; Chem 684. 1 cr.

**699. THESIS**
Year-long investigation in a selected topic, with background and experimental investigation. For chemistry majors who have completed Chem 548, 762, 684. Required for B.S. chemistry majors and strongly recommended for B.A. chemistry majors with a 2.5 average; /or permission. Lab. 4 cr.

**708. RESEARCH TECHNIQUES**
Lectures and laboratory to show experimental methods and interpretation of results. Topics include chromatography, data handling, nuclear magnetic resonance, mass spectrometry, elementary electronics, infrared and ultraviolet spectroscopy, experimental design, and X-ray. 1-3 cr.

**755. ADVANCED ORGANIC CHEMISTRY**
Methods of synthesis and determination of structure, including stereochemistry, of complex organic compounds. Prereq: Chem 548 or 652 or equivalent. (Chem majors must register for 756 concurrently.) 3 cr.

**756. ADVANCED ORGANIC CHEMISTRY LABORATORY**
Synthesis and structural determination of complex organic compounds, techniques for the separation, determination of purity, and identification of compounds by spectroscopic and chemical means. (Must be taken concurrently with 755 by Chem majors.) 2 cr.

**762. INSTRUMENTAL METHODS OF CHEMICAL ANALYSIS**
Theory, instrumentation, and application of methods such as atomic absorption, conductimetry, coulometry, emission spectrography, gas chromatography, polarography, potentiometry, and spectrophotometry to chemical analysis. Prereq: Chem 406; Chem 684 as a pre- or corequisite; /or permission. (Students must register for 763 concurrently.) 3 cr.

**763. INSTRUMENTAL METHODS OF CHEMICAL ANALYSIS LABORATORY**
Experimental parameters, error analysis, and applications of the methods covered in Chem 762. (Must be taken concurrently with 762.) 2 cr.

**774. INORGANIC CHEMISTRY**
Basic theoretical concepts and their applications to inorganic reactions and compounds. Prereq: Chem 683; Chem 684 pre- or corequisite; /or permission. (Undergraduates must take 775 concurrently.) 3 cr.

**775. INORGANIC CHEMISTRY LABORATORY**
Synthesis and characterization of inorganic compounds with an emphasis on techniques not taught in other laboratory courses. (Undergraduates must take 774 concurrently.) 2 cr.

**776. PHYSICAL CHEMISTRY III**
Quantum theory; spectroscopy; chemical bonding; statistical thermodynamics. Prereq: Chem 683-684. Lab. 4 cr.

**778. CHEMISTRY OF LARGE MOLECULES**
Basic chemistry of high-molecular-weight compounds, including synthetic polymers and substances occurring in living systems. Elementary aspects of the structures, syntheses, and properties of large molecules, and their roles in modern science, technology, and living systems. Prereq: one semester of organic chemistry. 4 cr.

# Civil Engineering (CiE)

**Chairperson:** Paul L. Bishop

**Professors:** Charles O. Dawson, emeritus; Russell R. Skelton, emeritus; Tung-Ming Wang
**Associate Professors:** Robert P. Vreeland, emeritus; Paul L. Bishop, Charles H. Goodspeed, Louis H. Klotz, Paul J. Ossenbruggen
**Adjunct Associate Professor:** Gerald M. Batchelder
**Assistant Professors:** Yen-hsi Chu, Pedro A. De Alba, David L. Gress, Dennis J. O'Brien, John A. Olofsson, Jr.
**Assistant Professor:** Robert P. Moynihan (Civil Technology)

**400. CIVIL ENGINEERING LECTURES**
Introduction to the profession; the civil engineer as a planner, builder, and problem solver; and the goals of the civil engineering curriculum. Lectures by faculty and visitors. Required of CiE freshmen; open to others by permission. 0 cr. Cr/F.

**501. SURVEYING**
For non-civil-engineering students. Theory and use of tape, level, transit, and aerial photographs in making plane and topographic surveys; use of surveys as a basis for deeds, maps, construction, design, environmental studies; reports involving the use of land or other natural resources. Lab. 4 cr.

**505. SURVEYING**
Principles of land measurements by ground and photogrammetric methods. Application of error theory to planning and adjusting engineering surveys. Conformal mapping and its applications to state plane coordinate systems. Prereq: Math 425-426. Lab. 4 cr.

**508. ENGINEERING GRAPHICS**
Orthographic projection and fundamentals of descriptive geometry. Lab. 2 cr.

**525. MECHANICS I**
An introduction to statics. Two- and three-dimensional force systems, the concept of equilibrium, analysis of trusses and frames, centroids, bending moment and shear force diagrams, friction, and stress-strain relationships. Prereq: Math 425; Math 426; Phys 407. 3 cr.

**526. MECHANICS II**
An introduction to strength of materials. Analysis of members under torsion, axial, shear, and bending stresses; superposition of stresses; stability of columns. Prereq: CiE 525. 3 cr.

**527. MECHANICS III**
An introduction to particle and rigid body dynamics. Rectilinear and curvilinear motion, translation and rotation, momentum and impulse principles, and work-energy relationships. Prereq: CiE 525 or permission. 3 cr.

**621. TRANSPORTATION PLANNING AND DESIGN**
Determining public transportation needs. Planning; the comparison and evaluation of alternative system modifications. Analysis of impacts of transportation facilities. Geometric design and traffic capacity of highways. Prereq: CiE major or permission. 3 cr.

**622. ENGINEERING MATERIALS**
Structural properties and applications of the various materials used in civil engineering work, including steel, cement, mineral aggregates, concrete, timber, and bituminous materials. Microstructure and properties of common metals, plastics, and ceramics. Prereq: CiE 526. Lab. 4 cr.

**623. SYSTEMS ANALYSIS**
Quantitative and economic techniques for optimum allocation of resources in planning and design of physical systems. Calculus methods for constrained and unconstrained optimization problems, linear programming, dynamic programming, and benefit/cost economics. Case studies illustrate techniques in analyzing construction, structural, environmental, and transportation engineering problems. Prereq: Math 527 or equivalent. 3 cr.

**642. FLUID MECHANICS**
Properties of fluids, fluid statics, continuity, momentum and energy equations, flow resistance. Measurement of fluids. Prereq: CiE 527. Lab. 4 cr.

**643. INTRODUCTION TO ENVIRONMENTAL POLLUTION CONTROL**
Environmental engineering; causes and consequences of environmental pollution. Water pollution, air pollution, solid waste management, thermal pollution, radiological health, and occupational health. Prereq: Chem 403. 3 cr.

**644. WATER AND WASTEWATER ENGINEERING**
Fundamental design concepts for operations and processes used in water treatment and water pollution control. Prereq: CiE 643. 3 cr.

**665. SOIL MECHANICS**
Soil classification and physical properties. Permeability, compressibility, bearing capacity, settlement, and shear resistance are related to the behavior of soils subjected to various loading conditions. Prereq: CiE 622. Lab. 4 cr.

**681. STRUCTURAL ANALYSIS**
Analytical stress and deflection analysis of determinate structures under static and moving load. Computer solution of beams and trusses by classical and matrix methods. Prereq: CiE 525-526. 4 cr.

**682. STRUCTURAL DESIGN CONCEPTS**
Structural synthesis and design; modeling concepts for analysis-design cycles by manual and computer approaches; development of design criteria; and general structural system behavior. Prereq: CiE 681. 4 cr.

**685. INDETERMINATE STRUCTURES**
Analysis of indeterminate structures; nonprismatic members subject to static and moving loads. Solution by classical, numerical, and computer-applied methods. Prereq: CiE 681. 4 cr.

**695. CIVIL ENGINEERING PROJECTS**
Independent research, under faculty guidance, of a subject of particular interest to an individual or a small group. Prereq: approval of faculty member involved. 2-4 cr.

**701. ADVANCED SURVEYING**
Instrumental and analytical photogrammetry. Conformal mapping and its application to the state plane coordinate systems. Geodetic surveying. Error theory and its application to the planning and adjustment of surveys. Application of electronic computers to surveying calculations. Prereq: CiE 505. Lab. 4 cr.

**711. COMMUNITY PLANNING**
Student project course focusing on real community problems. Issues investigated include population growth, community needs, economic and legal problems. Land-use models, survey techniques, and economic evaluation methods. Prereq: senior standing; permission. A year-long course; 2 credits each semester. "IA" grade (continuous course) will be given at the end of the first semester. 4 cr.

**714. CONTRACTS, SPECIFICATIONS, AND PROFESSIONAL RELATIONS**
Essential elements and legal requirements of engineering contracts; purposes and content of specifications; professional conduct, relations, registration, and ethics. Construction planning and management; cost analysis based on quantity surveys and unit-cost methods. Prereq: permission. 3 cr.

**721. PAVEMENT DESIGN**
Flexible and rigid pavements and bases for highways, airports, and city streets; pavement selection, construction methods, materials, specifications, and engineering cost estimates. Prereq: CiE 665. 3 cr.

**722. PROPERTIES AND PRODUCTION OF CONCRETE**
Basic principles of hydraulic cements and mineral aggregates, and their interactions in the properties of plastic and hardened concrete; modifications through admixtures; production handling and placement problems; specifications; quality control and acceptance testing; lightweight, heavyweight, and other special concretes. Prereq: CiE 622 or permission. 3 cr.

**723. BITUMINOUS MATERIALS AND MIXTURES**
Consideration of major types of bituminous materials, asphalt cements, cutback asphalts, asphalt emulsions, and tars; influence of chemical composition on physical properties; desirable aggregate characteristics for bituminous mixtures; construction techniques; current practices for determining optimum asphalt contents. Prereq: CiE 622 or permission. 3 cr.

**731. NETWORK PLANNING AND SCHEDULING**
Application of critical path methods (CPM) and project evaluation review technique (PERT) to the design and control of engineering projects. Lab. 2 cr.

**740. RURAL WASTEWATER ENGINEERING**
Methods for collecting and treating wastewater in small communities and rural areas. Biological and physicochemical treatment systems for small communities; land application; soil absorption; gray water treatment; and septage treatment. Prereq: CiE 643. 3 cr.

**741. OPEN CHANNEL FLOW**
Energy and momentum principles in open channel flow; flow resistance; channel controls and transitions; unsteady open channel flows; convective and dispersive transportation of pollutants; and basic modeling techniques. Prereq: CiE 642. 3 cr.

**743. ENVIRONMENTAL SAMPLING AND ANALYSIS**
Laboratory exercises in the techniques of water, wastewater, and solid-waste sampling and analysis. Interpretation of results from pollution surveys and operation of pollution control facilities; statistics of sampling and statistical evaluation of analytical data. Prereq: Chem 403, 404. Lab. 2 cr.

**744. ENVIRONMENTAL LIMNOLOGY**
Biological, chemical, and physical processes that occur in lakes and impoundments are explored and interpreted with respect to the cultural activities of man. Basic concepts of lake origin, morphometric and trophic status, water movement and stratification, nutrient cycling, etc. Current limnologically related problems are explored from the environmental engineering standpoint. Term projects involving laboratory field work and readings in the current scientific literature are required. Prereq: permission. Lab. 4 cr.

**745. HYDROLOGY AND HYDRAULICS**
Occurrence and physical effects of water on the earth; meterology, groundwater runoff and stream-flow routing, open-channel flow, reservoirs, control works, hydroelectric power, irrigation, drainage, and multipurpose projects. Prereq: CiE 642. 3 cr.

**746. WASTEWATER TREATMENT PLANT DESIGN**
Choice of treatment units. Design of the components; preparation of a plan for a particular city that includes a suitable combination of the units previously designed. Prereq: CiE 644. 3 cr.

**748. SOLID WASTE DISPOSAL**
Basic concepts and theory of collection and disposal systems. Design methods involved in disposal systems. Prereq: CiE 643 or permission. 3 cr.

**749. CHEMISTRY OF NATURAL WATERS**
Chemical equilibrium concepts applied to natural waters. Buffer systems; carbonate equilibria, acid-base equilibria. Chemical principles of water and wastewater treatment. Equilibrium modeling of natural waters and treatment processes. Water softening, phosphate removal, chemical precipitation. Prereq: Chem 403, 404. 3 cr.

**751. TRANSPORTATION PLANNING**
Transportation demand forecasting techniques applied to regional and urban situations. Calibration and use of mathematical models for forecasting land use, trip generation, trip distribution, modal choice, and trip assignment. Prereq: Math 644. 3 cr.

**752. TRAFFIC ENGINEERING**
Statistical and probabilistic methods to analyze and design roadway facilities. Level of service and capacity analysis of roadways under uninterrupted and interrupted flow conditions. Queuing theory and simulation models, design of traffic facilities. Prereq: Math 644. 3 cr.

**757. COASTAL ENGINEERING AND PROCESSES**
Introduction to small amplitude and finite amplitude wave theories. Wave forecasting by significant wave method and wave spectrum method. Coastal processes and shoreline protection. Wave forces and wave structure interaction. Introduction to mathematical and physical modeling. Prereq: CiE 632 or permission. 3 cr.

**763. ADVANCED SOIL MECHANICS I**
Current methods of determining soil strength and compressibility. Application to earth pressure, bearing capacity, slope stability, and settlement problems. Prereq: CiE 665. 4 cr.

**765. FOUNDATION ENGINEERING**
Subsurface investigation, excavation problems. Selection of foundation type. Design of footings, rafts, pile foundations, bulkhead walls. Prereq: CiE 682; CiE 763. 4 cr.

**768. SEEPAGE THROUGH EARTH STRUCTURES**
Groundwater flow, Darcy's Law, flow nets, Depuit's theory and application, conformal mapping techniques, confined flow, flow through earth and rock structures, seepage toward wells. Prereq: CiE 642 and 665. 2 cr.

**782. TIMBER DESIGN**
Properties and characteristics of structural woods, mechanics of wood, connection methods, design of timber members, and connections in beams, columns, and trusses, and glued laminates of wood. Prereq: CiE 682; permission. 2 cr.

**784. STRUCTURAL ANALYSIS BY MATRIX AND NUMERICAL METHODS**
Unifying concept of basic structural analysis theories; matrix and numerical methods of analysis, and their application by linear graph concepts using computers. Prereq: CiE 685. 4 cr.

**785. INTRODUCTION TO STRUCTURAL DYNAMICS**
Dynamic analysis of single- and multi-degree-of-freedom systems. Simple beam and frame structures. Earthquake analysis and design. Co- or prereq: CiE 685. 3 cr.

**790. INELASTIC STRUCTURAL DESIGN**
Continuation of modern design theory; ultimate design of reinforced concrete; plastic analysis of steel structures. 4 cr.

**793. STRUCTURAL DESIGN IN STEEL**
The design of members and connections: tension and compression members, beams, plate girders; riveted, bolted, and welded joints. Introduction to plastic design of beams and frames. Prereq: CiE 682 or permission. 4 cr.

**794. REINFORCED CONCRETE DESIGN**
The design of reinforced concrete members by Strength Design Theory including beams, columns, beam-columns, and slabs for strength and deformations. Prereq: CiE 682. 4 cr.

**795-796. INDEPENDENT STUDY**
A limited number of qualified senior and graduate students will be permitted to pursue independent studies under faculty guidance. Seniors may write terminal theses reporting the results of their investigations. 1-4 cr.

# Classics

(see Ancient and Modern Languages and Literatures)

# Communication Disorders (Comm)

**Chairperson:** F. Harry Tokay

**Associate Professors:** Frederick P. Murray, F. Harry Tokay
**Assistant Professors:** Fred C. Lewis, Charles W. Martin
**Lecturer:** Yvonne Daniels

**Comm 520 is a prerequisite for all courses in the department.**

**520. SURVEY OF COMMUNICATION DISORDERS**
Causes, diagnosis, and treatment of speech, language, and hearing disorders. 4 cr.

**521. ANATOMY AND PHYSIOLOGY OF THE SPEECH AND HEARING MECHANISM**
Anatomy, physiology, neurology, and function of the mechanisms for the production and perception of speech. 4 cr.

**524. APPLIED PHONETICS OF AMERICAN ENGLISH**
International Phonetic Alphabet; its practical application to speech therapy and/or the student's professional interest. 4 cr.

**631. SPEECH PATHOLOGY I**
Normal development of speech and language. Research and therapy procedures as applied to communication disorders, articulation, and voice. 4 cr.

**632. SPEECH PATHOLOGY II**
Diagnosis, therapy, and counseling procedure applied to communication disorders; emphasis on stuttering, cleft palate, cerebral palsy, and aphasia. Prereq: Comm 631 or permission. 4 cr.

**634. CLINICAL PRACTICE IN SPEECH PATHOLOGY**
Supervised experiences in diagnosis and therapy with speech-handicapped children and adults. Experiences with school-age children in individual and group therapy. Prereq: Comm 524 and 632. 4 cr. Cr/F.

**638. THE ACQUISITION OF LANGUAGE**
Review of research and theories in speech pathology, education, linguistics, and learning theory related to development of language in the normal child. 4 cr.

**650. PRINCIPLES AND PRACTICE OF PUBLIC SCHOOL SPEECH THERAPY**
Principles, goals, and philosophy of public school speech and language therapy. Supervised practicum. Prereq: Comm 634. Lab. 4 cr.

**660. SPECIAL PROBLEMS IN COMMUNICATION DISORDERS**
Individual or group projects to enrich or expand theoretical knowledge and to afford an opportunity for applied experience. Permission and arrangement with faculty. May be repeated to a maximum of 8 credits. 2, 4, 6, or 8 cr.

**704. BASIC AUDIOLOGY**
Normal hearing process and pathologies of the auditory system. Hearing screening, pure-tone testing, and speech audiometry. Prereq: Comm 521 or permission. 4 cr.

**705. INTRODUCTION TO AUDITORY PERCEPTION AND AURAL REHABILITATION**
Research, testing, and clinical procedures of auditory perception, applied to the communicatively impaired. Prereq: Comm 704; permission. 4 cr.

**706. STUTTERING**
Theoretical and therapeutic considerations of the stuttering syndrome; emphasis upon clinical management. Prereq: Comm 632 or permission. 4 cr.

**780. SEMINAR IN DIAGNOSIS OF SPEECH AND LANGUAGE DISORDERS**
Principles and practice for diagnosis of speech and language disorders; examination procedures and measurement techniques. Prereq: Comm 632. 4 cr.

**795. INDEPENDENT STUDY**
Application of the theory to specific communication disorder areas for individual or group projects. Prereq: permission. May be repeated to a maximum of 8 credits. 2, 4, 6, or 8 cr.

# Community Development

(See Institute of Natural and Environmental Resources)

# Computer Engineering

(See Electrical and Computer Engineering)

# Computer Science

(See Mathematics and Computer Science)

# Division of Continuing Education (DCE)
# Career Option Courses

**Director of Division of Continuing Education:** Edward J. Durnall

Additional career option courses appear under Administration and Secretarial Studies. Consult the Associate in Arts Degree chapter, Degree Options section, for course numbers.

**506, 606. FIELD EXPERIENCE**
Supervised work experience with planned learning objectives relating to either the student's career option or the student's major area of concentration. Associate in Arts degree candidates and students with minors in career option fields should register for 506; students engaged in supervised work experience related to their baccalaureate area of concentration should register for 606. Prereq: permission. May be repeated to a maximum of 8 credits. 2-8 cr.

**599. SPECIAL TOPICS**
Occasional course offerings of specialized material in A.A. career options; general studies topics for nontraditional learners; travel/study programs. Prereq: permission. 1-4 cr.

## Accounting

**462-463. PRINCIPLES OF FINANCIAL ACCOUNTING**
Two-semester sequence covering the principles of financial accounting. Double-entry, accrual accounting model and its application to service and merchandising firms. Accounting cycle, from the design of the system and the analysis of transactions to the final preparation of financial statements. 4 cr.

**561. PRINCIPLES OF COST ACCOUNTING**
Accounting for the flow of manufacturing costs in an industrial firm. Accounting for raw materials, direct labor and factory overhead, flow of costs in acquisition, work-in-progress, and finished goods to costs of goods sold. Job order and process cost systems, and concepts of standard and variance analysis. Prereq: DCE 462. 4 cr.

**562. TAX PRINCIPLES AND PROCEDURES**
Principles of federal, state, and local taxes; emphasis on federal income tax. Principles of taxation, tax planning, tax accounting, and the preparation of basic individual and business returns. New Hampshire and local taxes. Prereq: DCE 462. 4 cr.

**563. PRINCIPLES OF MANAGERIAL ACCOUNTING**
Need for and analysis of accounting data in the managerial planning and control process. Use of accounting information in the management of ongoing operations, in special nonrecurring decisions, and in long-range planning and capital budgeting. Prereq: DCE 462-463; DCE 561. 4 cr.

## Banking

**440. MONEY AND BANKING**
American financial system. How money is created and affects economy. Monetary policy. Pre- or coreq: DCE 530 or Econ 401. Not open to students who have had Econ 635. 4 cr. (Not offered every year.)

**441. BANK OPERATIONS**
Cash management and control, clearing and collections operations, loan and deposit administration, internal audit, and ancillary services. Pre- or coreq: DCE 432 or 462. 4 cr. (Not offered every year.)

**540. BANK INVESTMENTS**
Investment and portfolio analysis in relation to bank operations; constraints affecting liquidity, safety, and profitability; types of securities; optional timing of investment transactions. Prereq: DCE 440. 4 cr. (Not offered every year.)

## Craftsmanship (Stringed Instruments)

**491. BASIC CRAFTSMANSHIP**
Practices and procedures of an artisan craft demonstrated and explained by a master craftsman. May be repeated up to 4 credits. Prereq: permission. 1-4 cr.

**591. ADVANCED CRAFTSMANSHIP**
Artisan craft design and construction: applications and techniques. May be repeated up to 4 credits. Prereq: DCE 491 or permission. 1-4 cr.

**592. SEMINAR IN CRAFTSMANSHIP**
Readings and discussions on the social, cultural, historical, and technical aspects of an artisan craft. May be repeated up to 4 credits. Prereq: permission. 1-4 cr.

**593. SUPERVISED CRAFTSMANSHIP**
A) Violin; B) Stringed Instrument; C) Keyboard Instrument. May be repeated up to 4 credits. Prereq: permission. 1-4 cr.

## Criminal Justice

**550. CRIMINAL JUSTICE ADMINISTRATION AND ORGANIZATION**
Contemporary methods of administrative practice for efficient use of personnel, facilities, and equipment; planning and research; budgeting and control; decision making; communications. 4 cr. (Not offered every year.)

**551. CRIME PREVENTION AND CONTROL**
Coordinating the efforts of the community and criminal justice agencies. Problem solving in specific crime analysis—the offense, the offender, and community environment. 4 cr. (Not offered every year.)

**552. CORRECTIONS TREATMENT AND CUSTODY**
Scientific diagnosis and treatment of offenders. Institutional administration methods—climate, personnel, structure, and procedure. 4 cr. (Not offered every year.)

**554. JUVENILE JUSTICE ADMINISTRATION AND ORGANIZATION**
Techniques and methods of organizing and administering police juvenile units: role, function, and responsibilities of juvenile officers within the juvenile justice system. Prereq: permission. 4 cr. (Not offered every year.)

**555. DELINQUENCY PREVENTION AND CONTROL**
Causes of delinquency; pathogenic patterns; and diagnosis of child abuse. Prevention and treatment of child abuse and delinquency through coordination of the efforts of community and criminal justice agencies. Prereq: permission. 2 cr. (Not offered every year.)

## Insurance

**420. PRINCIPLES OF INSURANCE**
History, ethics, and the theory of risk. Major types of insurance. Operation and administration of an agency. 4 cr.

**421. LIFE AND HEALTH INSURANCE**
Insurance programs for the individual. History; types of contracts; legal concepts; and government, group, and individual programs. 4 cr. (Not offered every year.)

**422. PROPERTY, LIABILITY, AND MARINE INSURANCE**
Fire, casualty, transportation, marine and aircraft insurance; fidelity and surety bonds; worker's compensation; underwriting, loss adjustment, and prevention; government regulations, rate making, and reinsurance. 4 cr. (Not offered every year.)

## Library Science

**401. INTRODUCTION TO LIBRARIES**
History; role as a social institution; philosophy of library service; tools, techniques, and routines of library work. 4 cr. (Not offered every year.)

**402. CLASSIFICATION**
Dewey Decimal and Library of Congress classification systems; typing and filing cards; subject-heading theory and use; maintenance of shelf-list and other files. 4 cr. (Not offered every year.)

**403. SUPPORT FOR PUBLIC SERVICES**
Reference and bibliographic tools; philosophy of reference services; reference works in all types of libraries. 4 cr. (Not offered every year.)

**501. NONBOOK MATERIALS AND SERVICES**
Technical organization and operation of audio-visual materials, services, and equipment. 4 cr. (Not offered every year.)

**502. ACQUISITION AND CIRCULATION SYSTEMS**
Acquisition and processing of materials; the technical aspects of circulation systems. 4 cr. (Not offered every year.)

**503. CHILDREN'S LIBRARY SERVICE**
Materials for children; procedures and techniques for working with children; implementation of special programs; selection of materials; reference methods. 4 cr. (Not offered every year.)

## Management

**430. MANAGEMENT PRINCIPLES AND ORGANIZATION**
Management philosophy and practices; organization, structure, communication, planning, controlling, and decision making. Not open to Admn or Hotl majors. 4 cr.

**431. HUMAN BEHAVIOR AND SUPERVISION**
Nature of people at work; leadership; informal organization; employee training and development; motivation, morale, and performance appraisal; and counseling for improvements. Can be offered as one-credit modules in: Human Relations and Motivation, Effective Supervision, Employee Training and Development, and Employee Relations. Career option students required to complete 431 must take 4 credits. Not open to Admn or Hotl majors. 1-4 cr.

**432. PRINCIPLES OF ACCOUNTING**
Sole proprietorship, partnership, and the corporation; recording, summarizing, and reporting data; systems to account for and control purchases, sales, cash, receivables, and inventory; valuation of assets and measurements of income. Not open to students who have had Admn 502 or DCE 462 or to A.A. degree candidates in accounting career option. 4 cr.

**530. ECONOMICS**
U.S. economy and its component units. Macro- and microeconomic perspectives. Not open to students who have had Econ 401 or 402, or REco 411. 4 cr.

**531. SALESMANSHIP**
Principles and techniques of personal selling; customer needs and satisfaction. 4 cr.

**532. BUSINESS LAW**
Legal theory, practice, and precedents in everyday business situations. Not open to students who have had Admn 647. 4 cr.

**533. CREDIT MANAGEMENT**
Credit—its effect on the money supply and its role in the economy; commercial and consumer borrowing; credit policy, analysis, and regulations; secured and unsecured credit; collections; receivables; management of credit; and decision making. 4 cr. (Not offered every year.)

**534. SMALL BUSINESS MANAGEMENT ISSUES**
The environment of small business. Topics include: financial planning and procedures for starting a small business; developing and establishing a marketing plan; operating a going business; franchising; and cash flow management. 4 cr. (Not offered every year.)

## Merchandising

**410. FUNDAMENTALS OF MERCHANDISING**
Practices and procedures in marketing goods and services; retailing and wholesaling; channels of trade; functions of middlemen. Not open to Admn or Hotl majors. 4 cr. (Not offered every year.)

**411. PROMOTION AND ADVERTISING**
Mass communications in marketing; use of advertising media; integration of promotional plans and sales techniques; evaluation of promotional efforts. Not open to Admn or Hotl majors. 4 cr. (Not offered every year.)

**510. RETAILING**
Managing a goods or services retail enterprise; store location and organization, layout, buying and pricing, advertising and sales promotion, inventory control, and personnel policies. 4 cr. (Not offered every year.)

**512. FASHION MERCHANDISING AND DISPLAY**
Principles and procedures used in selection, promotion, and selling of fashion apparel and accessories. Analysis of principles of display. Prereq: DCE 410 or permission. 4 cr. (Not offered every year.)

## Quality Control

**480. FUNDAMENTALS OF QUALITY CONTROL**
Planning, organizing, and administering quality control operations in relation to company policy and objectives. 4 cr. (Not offered every year.)

**580. QUALITY CONTROL ENGINEERING**
Pre-process, in-process, and post-process control techniques. Data accumulation, classification, evaluation, measurement, reporting, and costs. Prereq: DCE 480 or permission. 4 cr. (Not offered every year.)

**581. STATISTICAL APPLICATIONS TO QUALITY CONTROL**
Tendency and variation, normal curve applications, histogram analysis, control charts, sampling plans, and Dodge-Romig and Military Standard Tables. Prereq: DCE 480 or permission. 4 cr. (Not offered every year.)

**582. PROCUREMENT QUALITY CONTROL**
Optimizing the quality of incoming materials and supplies. Quality specifications, receipt, source inspection, and vendor surveys and ratings. Prereq: DCE 480 or permission. 4 cr. (Not offered every year.)

## Real Estate

**425. FUNDAMENTALS OF REAL ESTATE**
History and development of property ownership; title and legal processes; limitations and restrictions of rights, contracts, and agreements; deeds and transfer of property. 4 cr.

**426. REAL ESTATE APPRAISAL**
Principles of land and building analysis, cost estimation, depreciation, and influences affecting value of residential and commercial property. Prereq: DCE 425. 4 cr. (Not offered every year.)

**525. REAL ESTATE LAW**
Fundamentals of real estate law; nature and classes of property; ownership; purchase and sales; and rights, duties, and responsibilities of the broker. 4 cr.

**526. REAL ESTATE FINANCE**
Mortgages, loans, and financing residential and commercial property. 4 cr. (Not offered every year.)

## Traffic and Distribution Management

**470. INTRODUCTION TO TRANSPORTATION AND TRAFFIC MANAGEMENT**
Characteristics and operations of the various modes and classes—common, contract, exempt, and private. Relationship between distribution management and other operational activities. 4 cr. (Not offered every year.)

**471. CARRIER OPERATIONS**
Principles of freight traffic; shipper-carrier relations. Terminal operations, freight handling, dispatching, inventory controls, employee relations, and other areas related to the operation of the transportation industry. 4 cr. (Not offered every year.)

**570. PRINCIPLES OF PHYSICAL DISTRIBUTION**
Elements involved in physical distribution and their interrelationships: inventory management, warehousing, industrial packaging, materials handling, physical flow, labor relations, cost control, forecasting. 4 cr. (Not offered every year.)

**571. TRANSPORTATION REGULATIONS**
Relationships among federal, state, and international regulatory agencies and the modes and classes of transportation. Interstate Commerce Act application and interpretation; handling and filing of claims; documentation; export-import regulations; safety requirements; and labor contracts. Prereq: DCE 470 or permission. 4 cr. (Not offered every year.)

# Earth Sciences (ESci)

**Chairperson:** Herbert Tischler

**Professors:** Donald H. Chapman, emeritus; T. Ralph Meyers, emeritus; Henri E. Gaudette, Cecil J. Schneer, Herbert Tischler
**Adjunct Professor:** Robert I. Davis
**Associate Professors:** Franz E. Anderson, Francis S. Birch, Wallace A. Bothner, Glenn W. Stewart
**Assistant Professors:** Wendell S. Brown, Theodore C. Loder, Paul A. Mayewski

**401. PRINCIPLES OF GEOLOGY I**
The earth; earth materials (rocks and minerals), landforms, and the processes that form them (volcanism, earthquakes, glaciation, etc.). Field trips. Lab. 4 cr.

**402. PRINCIPLES OF GEOLOGY II**
The geological history of the earth: an interpretation of past geologic events emphasizing the geological development of North America and the evolution of life. Prereq: ESci 401. Lab. 4 cr.

**409. ENVIRONMENTAL GEOLOGY**
Environmental impact of geologic processes; natural hazards—landslides, earthquakes, volcanoes, flooding, erosion, and sedimentation; land exploitation and site investigations; environmental considerations of water-supply problems; the recovery of energy and mineral resources. Prereq: ESci 401 or permission. 4 cr.

**501. INTRODUCTION TO OCEANOGRAPHY**
Physical, chemical, geological, and biological processes in the sea. 4 cr.

**502. INTRODUCTION TO OCEANOGRAPHY LABORATORY**
Laboratory complements and expands upon ESci 501 lectures; registration for ESci 502 is optional. Navigation, tides, currents, waves, chemical and physical aspects of seawater, pollution, etc. Co- or prereq: ESci 501. 1 cr.

**503. INTRODUCTION TO MARINE SCIENCE**
Team-taught course under New Hampshire College and University Council (NHCUC). Physical, geological, chemical, and biological aspects of the oceans. Field trips. Saturday only. Prereq: permission. (No credit if completed ESci 501.) 4 cr.

**512. DESCRIPTIVE AND DETERMINATIVE MINERALOGY**
Physical and chemical properties of minerals; their associations; modes of occurrence; and uses; identification. Prereq: ESci 401; Chem 401 or 403 pre- or corequisite. Lab. 4 cr.

**531. STRUCTURAL GEOLOGY**
Structural units of the earth's crust and mechanics of their formation. Prereq: ESci 402. Lab and fieldwork. 4 cr.

**561. GEOMORPHOLOGY**
Processes leading to the development of landforms. Field trips. Prereq: ESci 401. Lab. 4 cr.

**595. SPECIAL PROJECT IN THE EARTH SCIENCES**
A) Oceanography. 1-4 cr.

**603. MARINE SCIENCE SUMMER INSTITUTE**
Six-week institute of three course offerings in marine-oriented disciplines. Lectures, labs, field trips, plus two weeks of intensive field work at the Cobscook Bay Marine Science Station. Student takes two out of the three courses. Prereq: Approval of campus representative of the Marine Sciences Committee of the New Hampshire College and University Council. Not for major credit in earth sciences. (May be repeated.) 8 cr.

**613. PRINCIPLES OF MINERALOGY**
Crystallography; principles of the physics and chemistry of natural solids; atomic structures of minerals and their investigation by X-ray diffraction. Prereq: ESci 401; Chem 401 or 403. Lab. 4 cr.

**614. PETROGRAPHY**
Description and classification of igneous, sedimentary, and metamorphic rocks in hand specimen and thin section; optical mineralogy. Prereq: ESci 512. Lab. 4 cr.

**652. INVERTEBRATE PALEONTOLOGY**
Classification, evolution, and environmental and stratigraphic significance of invertebrate animals as recorded by fossils. Field trip to collect fossils and examine ancient environments. Prereq: ESci 402 or Zool 412; /or permission. Lab. 4 cr.

**725. IGNEOUS AND METAMORPHIC PETROLOGY**
Textural, mineralogical, and chemical analysis, and phase rule and phase diagram interpretation applied to petrogenesis. Prereq: ESci 613, 614; /or permission. Lab. 4 cr.

**732. GEOLOGIC MAPPING AND INTERPRETATION**
Standard methods of geologic field mapping; interpretation of geologic maps and aerial photographs of selected areas. Course includes field mapping excursions to local areas and an 8-10 day exercise in a selected area of the Appalachian Mountains. $75 lab fee includes transportation and housing in the field. Prereq: permission. Lab. 4 cr.

**734. APPLIED GEOPHYSICS**
Gravity, magnetic, seismic, electrical, and thermal methods of investigating subsurface geology. Fieldwork and use of computers in data analysis. Prereq: Math 426 passed or taken concurrently; ESci 401; one year of college physics; /or permission. Lab. 4 cr.

**741. GEOCHEMISTRY**
Thermodynamics applied to geological processes; geochemical differentiation of the earth; the principles and processes that control the distribution and migration of elements in geological environments. 4 cr.

**752. CHEMICAL OCEANOGRAPHY**
Water structure, chemical composition and equilibrium models, gas exchange, biological effects on chemistry, trace metals, and analytical methods. Laboratory includes short cruise aboard R/V *Jere A. Chase*. Prereq: permission. Lab (optional). 3 or 4 cr.

**754. SEDIMENTATION-STRATIGRAPHY**
Sedimentation: weathering, transportation, and deposition of modern sediments. Stratigraphy: classification of sedimentary rocks and principles of stratigraphic correlation. Lab. 4 cr.

**758. INTRODUCTION TO PHYSICAL OCEANOGRAPHY**
Ocean basins; physical properties of seawater; atmosphere-ocean interaction; general ocean circulation; waves and tides; continental shelf and near-shore processes; instrumentation and methods used in ocean research. Simplified physical and mathematical models demonstrate the important concepts. Prereq: Phys 408; ESci 501; one year of college calculus; /or permission. Lab and field project. 4 cr.

**759. GEOLOGICAL OCEANOGRAPHY**
Major geological features and processes of the ocean floor; geological and geophysical methods; plate tectonics. Prereq: ESci 401; ESci 501; /or permission. 4 cr.

**762. GLACIAL GEOLOGY**
The glacial environment: glacier dynamics and glacial erosion and deposition. Review of world glacial stratigraphy in light of causes of glaciation and climatic change. Field trips. Prereq: ESci 401; ESci 561; /or permission. Lab. 4 cr.

**781. PHYSICAL GEOLOGY**
Materials and structures of the earth and erosive agents that modify them. Laboratory and field trips. For certified elementary or high school science teachers or for students in master's degree programs in education who need an introduction to the earth sciences. (Not available for credit after completing ESci 401 or equivalent.) 4 cr.

**782. HISTORICAL GEOLOGY**
Evolution of physical features and life on the earth. Fossil organisms; methods of historical geology; laboratory and field trips. Prereq: ESci 781 or equivalent. For certified elementary or high school science teachers or for students in master's degree programs in education who need an introduction to the earth sciences. (Not available for credit after completing ESci 402 or equivalent.) 4 cr.

**795. TOPICS IN EARTH SCIENCES**
A) Areal Geology; B) Geochemistry; C) Geomorphology, Advanced; D) Geophysics; E) Glacial Geology, Advanced; F) Groundwater Geology; G) Historical Geology, Advanced; H) Industrial Minerals; I) Micropaleontology; J) Mineral Fuels; K) Mineralogy, Advanced; L) Optical Crystallography; M) Ore Deposits; N) Paleontology, Advanced; O) Petrology, Advanced; P) Regional Geology; Q) Sedimentation; R) Stratigraphy; S) Structural Geology, Advanced; T) Marine Geology; U) Physical Oceanography; V) History of Geology; W) Earth Science Teaching Methods; X) Senior Synthesis; Y) Chemical Oceanography; Z) Glaciology, Advanced. Special problems by means of conferences, assigned readings, and field or laboratory work, fitted to individual needs from one of the areas listed above. 1-4 cr.

# Economics (Econ)

**Professors:** Carroll M. Degler, emeritus; John A. Hogan, emeritus; Ruth J. Woodruff, emerita; Robert F. Barlow, Manley R. Irwin, John J. Korbel, Sam Rosen, Kenneth J. Rothwell, Charles B. Warden, Jr., Dwayne E. Wrightsman
**Associate Professors:** Allan J. Braff, Dale G. Broderick, John M. Burt, Jr., Richard W. Hurd, Fred R. Kaen, Richard L. Mills, Robert C. Puth, Allen R. Thompson
**Assistant Professors:** Richard England, John Haskell, Marc Herold, Heidiemarie Sherman, Evangelos O. Simos
**Instructors:** Michael A. Conte, David J. Roddy
**Lecturers:** Michael Burnett, Harold Rafter

**400. ECONOMIC ISSUES**
Economic analysis applied to current issues such as environmental pollution, federal deficit spending, monopoly and waste, poverty, racism, the energy shortage, the urban crisis, war and the economy, etc., discussed in a nontechnical, conceptual framework. Reports and discussion on outside readings. No credit toward a major or minor in economics. 4 cr.

**401. PRINCIPLES OF ECONOMICS (MACRO)**
Basic functions of the United States' economy viewed as a whole; policies designed to affect its performance. Economic scarcity, supply and demand, the causes of unemployment and inflation, the nature of money and monetary policy, the impact of government taxation and spending, the federal debt, and issues concerning economic growth. 4 cr.

**402. PRINCIPLES OF ECONOMICS (MICRO)**
Functions of the component units of the economy and their interrelations. Units of analysis are the individual consumer, the firm, and the industry. Theory of consumer demand and elasticity, supply and costs of production, theory of the firm under conditions of perfect and imperfect competition, demand for and allocation of economic resources, general equilibrium, and basic principles and institutions of international trade. (Not open to students who have had REco 411.) 4 cr.

**515. ECONOMIC HISTORY OF THE UNITED STATES**
United States' economy from colonial times to the present. Models of economic development applied to the United States. How social, political, technological, and cultural factors shape economy; development and influence of economic institutions. 4 cr.

**518. EUROPEAN ECONOMIC HISTORY**
Western European economies from medieval times to the present. Explanations for differential growth rates and patterns; contrasts between political, social, and economic events. Prereq: Econ 401 or 402; /or permission. 4 cr.

**525. INTRODUCTION TO ECONOMIC STATISTICS**
Principal statistical concepts and techniques used in empirical economics: descriptive statistics, probability theory, random variables and their distributions, expected values, sampling inferential statistics, correlation and regression analysis, analysis of variance, time series analysis, index numbers. Also, principal sources of economic data. 4 cr.

**601. INCOME DISTRIBUTION: WEALTH AND POVERTY**
Examination of the distribution problem; historical development of distribution theories; comparative review of distribution systems, past and present. Students help select topics, e.g., distributive effects of the tax system and welfare policies to redistribute income. 4 cr.

**605. INTERMEDIATE MICROECONOMIC ANALYSIS**
Analysis of supply and demand. Determination of prices, production, and the distribution of income in noncompetitive situations and in the purely competitive model. General equilibrium. Prereq: Econ 402. 4 cr.

**611. INTERMEDIATE MACROECONOMIC ANALYSIS**
Macroeconomic measurement, theory, and public-policy determination. Prereq: Econ 401 and 402. 4 cr.

**615. HISTORY OF ECONOMIC THOUGHT**
Examination and critical appraisal of the work of major economists, including the work of contemporary economists, and major schools of economists, particularly with reference to the applicability of their theories to current economic problems. Prereq: Econ 401 and 402. 4 cr.

**626. INTRODUCTION TO QUANTITATIVE ECONOMICS**
Development of the concept of a simple, testable economic model of explanatory or forecasting type. Alignment of the model with reality by means of computer-performed statistical estimation. Types of error, consequences, and possible methods of dealing with errors. Prereq: Econ 525. 4 cr.

**630. COMPARATIVE STUDY OF ECONOMIC SYSTEMS**
Theoretical models of capitalism and socialism. Their historical implementation as exemplified by the United States, France, Yugoslavia, U.S.S.R., China, and Cuba. Prereq: Econ 401 and 402. 4 cr.

**635. MONEY AND BANKING**
Financial markets, financial institutions, monetary theory, monetary policy, causes and cures of inflation and related problems. Prereq: Econ 401 and 402. 4 cr.

**641. PUBLIC FINANCE**
Analysis of the public sector. Welfare, optimality, and market failure in the private sector. Optimal provision of public goods; corrections for externalities; optimal public expenditure policy. Analysis of tax effects and incidence. Optimal taxation policies. Prereq: Econ 401 and 402. 4 cr.

**645. INTERNATIONAL ECONOMICS**
Trade theory and commercial policy. Free trade, protection, common markets. Economic aspects of international relations, with particular reference to recent policy issues. Prereq: Econ 401 and 402. 4 cr.

**651. GOVERNMENT REGULATION OF BUSINESS**
Mergers, competition, monopoly, and the regulated industries. 4 cr.

**655. LABOR UNIONS AND THE WORKING CLASS**
Workers' role in the economy and unions as they form to protect their interests. History of the American labor movement; evaluation of the success of unions in fulfilling workers' needs. Management's relationship with workers in the context of a power struggle between unions and managers. Government's role in collective bargaining as intermediary and as employer. 4 cr.

**656. LABOR ECONOMICS**
Functioning of labor markets from theoretical and policy perspectives. Labor supply, wage determination, internal labor merkets, and barriers to upward labor market mobility. Poverty, unemployment, inflation, and wage-price controls. Prereq: Econ 401 and 402; /or permission. 4 cr.

**668. ECONOMIC DEVELOPMENT**
Analysis of problems and available solutions confronting the underdeveloped areas of the world. Prereq: Econ 401 and 402. 4 cr.

**695-696. INDEPENDENT STUDY**
Individual projects of special interest and benefit. Prereq: permission of undergraduate counselor and proposed project supervisor. Granted to students with unusual initiative. Variable (in multiples of 2) 2-12 cr.

**698. TOPICS IN ECONOMICS**
Special topics. May be repeated. Prereq: permission. 4 cr.

**711. ECONOMIC FLUCTUATIONS**
Recurrent movements of prosperity and depression; emphasis on causes and public-policy implications. Prereq: Econ 611 or permission. 4 cr.

**715. MARXIAN ECONOMIC ANALYSIS**
Marx's analysis of capitalism within the classical and radical tradition; methodology; organization of capital; labor theory of value; accumulation of capital; growth and distribution; economic crises. Critical evaluation of Marx's analysis. Prereq: Econ 605 and 611; /or permission. 4 cr.

**720. U.S. ECONOMIC HISTORY**
From colonial times to the present. Applied economic theory; economic models and interpretation of data. Influence of technology, industrialization, foreign trade, monetary factors, and government; noneconomic factors. Prereq: Econ 605 and 611; /or permission. 4 cr.

**721. EUROPEAN ECONOMIC HISTORY**
Western European and Mediterranean economies from medieval times to the Common Market. Economic models and interpretation of data. Capital accumulation, technology, trade, industrialization, monetary factors, and the role of government; relevant noneconomic factors. Prereq: Econ 605 and 611; /or permission. 4 cr.

**725. STATISTICAL THEORY**
Univariate and bivariate mathematical statistics; i.e., probability theory, discrete and continuous random variables and their distributions, moments and moment-generating functions, parameter estimation, hypothesis testing, correlation and regression analysis, analysis of variance. Prereq: Math 425-426 or equivalent. 4 cr.

**727. ECONOMETRIC THEORY**
Representation of economic phenomena in mathematical terms; formulation of models of economic activity and the derivation therefrom of propositions that are subject to statistical test, primarily by means of multivariate regression analysis. Prereq: Econ 725 or permission. 4 cr.

**735. ECONOMICS OF FINANCIAL MARKETS**
Economic analysis of financial market systems. Topics include financial market functions, theories of saving and investment, financial intermediation, flow-of-funds analysis, loanable funds theory, interest rate forecasting, portfolio theory, capital-asset pricing models, structure of interest rates (including term-structure theory), and macroeconomic models of the financial sector. Prereq: Econ 635. 4 cr.

**736. SEMINAR IN MONETARY THEORY AND POLICY**
Contemporary developments in monetary theory and the evaluation of policy measures. Prereq: Econ 635. 4 cr.

**737. DECISION THEORY AND BAYESIAN METHODS**
Utility, decision problems, prior and posterior distributions, sufficiency, estimation and hypothesis testing, linear models and sequential sampling. Emphasis on applications to business and economics. Prereq: Math 735. (Also offered as Math 737.) 4 cr. (Not offered every year.)

**741. SEMINAR IN PUBLIC FINANCE—THEORY AND POLICY**
Selected topics in contemporary theoretical and policy problems of public finance. Prereq: Econ 641. 4 cr.

**742. SURVEY OF URBAN ECONOMICS**
Theoretical and empirical bases; policy alternatives for the problems of poverty, housing, urban renewal, transportation, local fiscal affairs, and pollution. Prereq: Econ 605 or permission. 4 cr.

**745. INTERNATIONAL TRADE**
Contemporary issues in international economic theory and policy. Analysis of trade theory, dynamics of world trade and exchange, and international commercial policy. Prereq: Econ 645. 4 cr.

**746. INTERNATIONAL FINANCE**
International monetary mechanism; balance of payments, international investment; exchange rates, adjustment systems, international liquidity, foreign aid, multinational corporations. Prereq: Econ 401 and 402. 4 cr.

**751. GOVERNMENT REGULATION OF BUSINESS**
Analysis of government policy with reference to such problems as conspiracy, monopoly, mergers, unfair practices, and discrimination; legal and economic appraisal of government policy alternatives. Prereq: Econ 651. 4 cr.

**752. SEMINAR IN INDUSTRIAL ORGANIZATION AND PUBLIC POLICY**
Historical and contemporary developments in the theoretical and applied areas of industrial and commercial market structures, behavior, and performance. Prereq: Econ 651; permission. 4 cr.

**755. COLLECTIVE BARGAINING**
Historical development of the U.S. labor movement and the industrial relations system. Contemporary collective bargaining issues; the role of public policy in industrial relations. Prereq: Econ 655. 4 cr.

**756. LABOR ECONOMICS**
Recent developments in labor market analysis and public policies related to contemporary labor issues. Labor supply, the structure and stratification of labor markets, economic discrimination, unemployment and poverty, inflation, and wage-price controls. Prereq: Econ 656. 4 cr.

**758. MANPOWER AND EDUCATION PLANNING**
Flows of human beings within and between the educational and manpower sectors of the economy, also related to flows of goods and services in the industrial sector. Interrelationships of these flows; construction of a computer simulation model tracing the impact throughout the economy of manpower and educational planning decisions. Prereq: Econ 401 and 402; /or permission. 4 cr.

**761. NATIONAL ECONOMIC PLANNING**
Planning in a market economy: the new industrial state. Planning as a substitute for markets: the developing countries. Planning as a way of transforming society; socialist economies; techniques of planning social and political issues related to various planning methods. Prereq: Econ 605 and 611; /or permission. 4 cr.

**768. SEMINAR IN ECONOMIC DEVELOPMENT**
Theories of the development process; role of various forces of economic change in developing countries. Prereq: Econ 668. 4 cr.

**769. CASE STUDIES IN ECONOMIC DEVELOPMENT**
Problems and policies in selected countries; evaluations of national plans, programs, and projects; comparative analysis. Sections: A) Southeast Asia; B) Cost-Benefit and Project Analysis; C) Africa; D) South America. Prereq: Econ 401 and 402; /or permission. 4 cr.

**798. ECONOMIC PROBLEMS**
Special topics; may be repeated. Prereq: permission of adviser and instructor. 2 or 4 cr.

# Education (Educ)

**Chairperson:** Roland B. Kimball

**Coordinator of Teacher Education:** Stephen R. Birrell
**Professors:** Everett B. Sackett, dean emeritus; Thomas O. Marshall, emeritus; Angelo V. Boy, Bud B. Khleif, Roland B. Kimball, Carleton P. Menge, Gerald J. Pine
**Adjunct Professor:** Donald D. Durrell
**Associate Professors:** Joseph J. Petroski, emeritus; Michael D. Andrew, Charles H. Ashley, Jason E. Boynton, John G. Chaltas, Ellen D. Corcoran, David D. Draves, Donald H. Graves, David J. Hebert, M. Daniel Smith, Deborah E. Stone, Dwight Webb
**Adjunct Associate Professors:** Edward D. Durnall, Richard M. Goodman
**Assistant Professors:** Richard F. Antonak, John Arnold, Patricia M. Arredondo-Dowd, Robert B. Babcock, John J. Carney, Barbara J. Cline, Michael C. Diamonti, Ann L. Diller, Leo D. Geoffrion, Cynthia M. Homer, Lawrence N. McCullough, Sharon N. Oja, Mary B. Winslow
**Adjunct Assistant Professor:** David Cross
**Resident Supervisors:** Dell Chamberlain, William Childs, Bert Cohen, Erik Hake, Wayne Johnson, Alex Vaver, Kevin Wheeler

**500. EXPLORING TEACHING**
For students considering a teaching career. In-school experiences to develop introductory skills in observation and teaching. On-site seminars for analysis and evaluation. Assessment and advisement related to teaching as a career. Prerequisite for further work toward teacher certification. A minimum of seven hours a week, plus travel time, required. Prereq: permission. 4 cr. Cr/F.

**611. TEACHING ELEMENTARY SCHOOL SOCIAL STUDIES**
Objectives, content, methods, and materials. (Offered in Division of Continuing Education only.) 4 cr.

**612. TEACHING ELEMENTARY SCHOOL MATHEMATICS**
Objectives, content, methods, and materials. (Offered in Division of Continuing Education only.) 4 cr.

**613. TEACHING ELEMENTARY SCHOOL SCIENCE**
Involvement with strategies; inquiry and discovery approaches compared with more conventional methods; selection and justification of goals. Survey of resources available for science teachers; analysis of current curriculum projects. (Offered in Division of Continuing Education only.) 4 cr.

**691. SCIENCE CURRICULUM AND INSTRUCTION**
For inservice and preservice secondary teachers of physics, chemistry, earth science, or general science. Modern curricula and methods; contemporary programs of national interest. Science teaching goals and methods. 4 cr.

**694. COURSES IN SUPERVISED TEACHING**
Supervised Teaching of Physical Education. 8 cr. Cr/F.
Supervised Teaching of Occupational Education. 8 cr. Cr/F.
Supervised Teaching of Home Economics. 8 cr. Cr/F.
Supervised Teaching of Music. 8 cr. Cr/F.

**700. EDUCATIONAL STRUCTURE AND CHANGE**
Organization, structure, and function of American schools; processes of change in education; how successful innovation is accomplished. Field experience options. Sections listed in department before preregistration. Prereq: Educ 500 or permission. Minimum of 4 cr. required for teacher certification. Refer to *Time and Room Schedule*. 1, 2, or 4 cr.

**701. HUMAN LEARNING AND DEVELOPMENT: EDUCATIONAL PSYCHOLOGY**
Development, learning theory, and instructional theory applied to teaching. Various modules on the theories, research, and implications of specific topics offered each semester and summer. Sections listed in department before preregistration. Prereq: Educ 500 or permission. Minimum of 4 cr. required for teacher certification. Refer to *Time and Room Schedule*. 1, 2, or 4 cr.

**703. ALTERNATIVE TEACHING MODELS**
Analysis and application of basic teaching models and techniques (from teacher-directed to student-centered). Observation of master classroom teachers and exemplary video tapes; service as aides to master-teachers; seminars. Techniques and analysis systems through observation of video tapes, microteaching, completion of appropriate self-instruction units, and seminars. Sections listed in department before preregistration. Prereq: Educ 500 or permission. Minimum of 4 cr. required for teacher certification. Refer to *Time and Room Schedule*. 1, 2, or 4 cr.

**705. ALTERNATIVE PERSPECTIVES ON THE NATURE OF EDUCATION**
Students formulate, develop, and evaluate their own educational principles, standards, and priorities. Alternative philosophies of education; contemporary educational issues. Sections listed in department before preregistration. Prereq: Educ 500; permission. Minimum of 4 cr. required for teacher certification. Refer to *Time and Room Schedule*. 1, 2, or 4 cr.

**706. INTRODUCTION TO READING INSTRUCTION IN THE ELEMENTARY SCHOOLS**
Reading process; current procedures and materials; diagnostic techniques; practicum experience. Course satisfies reading requirement for prospective elementary teachers in the five-year teacher education program and may be included in the 12 required graduate credits in education at the graduate level. Courses may also be taken for undergraduate credit before entrance into fifth year; in this case the course satisfies reading requirement but is not applicable toward the 12 required graduate credits. Prereq: Educ 500. 4 cr.

**707. APPROACHES TO TEACHING READING AT THE SECONDARY LEVEL**
*The Reading Curriculum in the Secondary School*: structural components (developmental, corrective, remedial); materials and methods of instruction and appraisal; instruments of measurement and evaluation in the comprehensive secondary reading program. 2 cr. *Teaching Reading through the Content Areas: Alternatives and Application*: new approaches, concepts, and methodologies of teaching reading through content materials; workshop to develop and produce instructional strategies and materials for an integrated reading-content program. 2 cr. (Two credits of 707 may be used to satisfy 2 credits of Educ 700.)

**734. CHILDREN'S LITERATURE**
Interpretive and critical study of literature for children in the elementary, middle, and junior high schools. Methods of using literature with children. 4 cr.

**750. INTRODUCTION TO EXCEPTIONALITY**
Social, psychological, and physical characteristics of exceptional individuals including intellectual (gifted, retarded, learning disabled); sensory (visual, auditory); motor (orthopedic); health; and communication. Implications for educational and human service delivery. 4 cr.

**751. EDUCATING EXCEPTIONAL LEARNERS**
Issues in special education (labeling, mainstreaming, efficacy); techniques of special teaching (referral, assessment, observation, task analysis, profiling, selecting materials, intervention). Issues in special teaching (behavior modification, ability training). Primary application to mild and moderate handicaps. Co- or prereq: Educ 750 or permission. 4 cr.

**752. DIAGNOSIS AND REMEDIATION OF LEARNING DISABILITIES**
Terminology, etiology, common characteristics, and symptoms; theory and practice in gross-motor, visual, and auditory remediation; testing procedures used in diagnosis and remediation programs. 4 cr.

**753. TEACHING THE CHILD WITH EMOTIONAL AND SOCIAL DIFFICULTIES**
Nature and scope of emotional disturbances and social maladjustment in children, including causes, characteristics, and treatment programs. 2 cr.

**763. INTRODUCTION TO EDUCATIONAL MEDIA**
Educational media in the learning process; curricular integration of materials and equipment in the school library media center; design and implementation of learning systems that provide a framework for the development of individual skills. 4 cr.

**775. DIAGNOSTIC TEACHING OF READING**
Classroom implementation of diagnosis and remediation of reading disabilities; for teachers, counselors, administrators, and other school personnel. 4 cr.

**785. EDUCATIONAL TESTS AND MEASUREMENTS**
Theory and practice of educational evaluation; uses of test results in classroom teaching and student counseling; introductory statistical techniques. 4 cr.

**795, 796. INDEPENDENT STUDY**
Juniors and seniors only, with approval by appropriate faculty member. 2 or 4 cr.

**797. SEMINAR IN CONTEMPORARY EDUCATIONAL PROBLEMS**
Issues and problems of special contemporary significance, usually on a subject of recent special study by faculty member(s). Prereq: permission. May be repeated for different topics. 1-4 cr.

# Electrical and Computer Engineering (E E)

**Chairperson:** Ronald R. Clark

**Professors:** Leon W. Hitchcock, emeritus; Fletcher A. Blanchard, Ronald R. Clark, Albert D. Frost, John B. Hraba, Fred Manasse, Joseph B. Murdoch, Alden L. Winn
**Adjunct Professor:** Sidney W. Darlington
**Associate Professors:** Glen C. Gerhard, Filson H. Glanz, Donald W. Melvin, John L. Pokoski, Kondagunta Sivaprasad, Kerwin C. Stotz
**Assistant Professors:** L. Gordon Kraft, Paul J. Nahin, Dana B. Rogers

**401. INTRODUCTION TO ELECTRICAL ENGINEERING I**
Overview of electrical engineering profession; lectures by faculty and guests; field trips. Role of the electrical engineer as a professional; ethics of the engineering profession. 1 cr.

**402. INTRODUCTION TO ELECTRICAL ENGINEERING II**
Electrical network theory, with attention given to computerized network analysis. Prereq: Math 425. 1 cr.

**431. SPEECH, MUSIC, AND NOISE: THE SCIENCE OF SOUNDS**
Physical nature of sound waves. Production of sounds by mechanical vibration in string instruments, drums, loudspeakers, or by air column resonances in horns and organ pipes. Characteristics of hearing; human perception of sound, loudness, pitch, and intensity. Speech communication and the acoustics of the classroom, theater, or concert hall. Noise, its control and reduction; criteria for the judgement of annoyance. Application of acoustics and noise control for environmental protection and in industry, transportation, biology, and medicine. Amplification, storage, and reproduction of sound. Open for credit to nonengineering and nonphysics students only. Prereq: high school mathematics. Lab. 4 cr.

**432. LIGHT: SOURCES AND USES**
Edison's lamp to the laser; production of light; color, the spectrum, and the human eye; sources of light; lenses and reflectors; the four factors of seeing; designing lighting installations. Applications in schools, offices, factories, stores, the home; for sports and recreation, agriculture, and medicine; the ocean; and public buildings. Open for credit to nonengineering and nonphysics students only. Prereq: high school algebra and trigonometry. Lab. 4 cr.

**517. JUNIOR LABORATORY I**
Application of techniques in electrical engineering. Prereq: E E 551 taken concurrently. 1 cr.

**518. JUNIOR LABORATORY II**
Laboratory investigations synthesizing classroom knowledge in circuits, electronics, electromagnetics, and signal processing. Prereq: E E 552 and 656 should be taken concurrently with, or prior to, 518. 3 cr.

**531. ELEMENTS OF DIGITAL SYSTEMS**
Fundamental design and analysis principles. Number systems, switching algebra, logic circuits, codes, and an introduction to digital computers. Laboratory: student-built systems using modern integrated circuit technology; "hands-on" experience with a minicomputer. For non-E E majors. Lab. 4 cr.

**541-542. ELECTRICAL CIRCUITS I AND II**
Electrical circuits including DC, AC, and transient circuits. Linear circuit theory, power considerations, resonance conditions, Fourier series, Laplace transforms, and complex frequency analysis. Prereq: Math 426. Lab. 4 cr.

**543. INTRODUCTION TO DIGITAL SYSTEMS**
Fundamental design and analysis principles. Number systems, switching algebra, logic circuits, codes, and an introduction to digital computers. Laboratory: student-build systems using modern integrated circuit technology; "hands-on" experience with a minicomputer. For E E majors. Lab. 4 cr.

**544. SIGNAL PROCESSING FUNDAMENTALS**
Methods of analysis for distributed systems, continuous and discrete signals, and introductory probability and statistics for engineers. Prereq: Math 527. 3 cr.

**545. ELECTRICAL NETWORKS**
Topics such as two ports and transfer functions, resonance, Bode analysis, time and frequency domain concepts, state equations, introductory network synthesis, passive and active filter design, approximation, and transmission lines. Prereq: E E 541 and 544. 3 cr.

**548. BASIC ELECTRONIC AND ELECTROMECHANICAL CIRCUITS**
Applications, analysis and design principles of electronic and electromechanical devices. Topics include semiconductor diodes, transistors, biasing circuits, small signal models, amplifiers, magnetic circuits, transformers, transducers and introduction to rotating AC and DC machines. Prereq: E E 541. Lab. 4 cr.

**551. ADVANCED ELECTRONICS I**
Feedback theory, analysis and design with operational amplifiers, sinusoidal oscillators, modulators, detectors, and analog circuits. Prereq: E E 548. 3 cr.

**552. ADVANCED ELECTRONICS II**
Analysis and design of digital and switching circuits using both discrete and integrated components. Prereq: E E 543; E E 551. 3 cr.

**603. ELECTROMAGNETIC FIELDS AND WAVES I**
Maxwell's equations in integral and differential form; uniform plane waves in free space and material media; boundary conditions; simple transmission line theory; parallel plate and rectangular waveguides; simple radiating systems. Prereq: Math 527; E E 544 or equivalent. 3 cr.

**604. ELECTROMAGNETIC FIELDS AND WAVES II**
Loop antennas; aperture and cylindrical antennas; self and mutual impedence; receiving antennas and antenna arrays; bounded plane waves; rectangular and cylindrical waveguides; waveguide discontinuities and impedence matching; solid state microwave sources. Prereq: E E 603. 4 cr.

**605. ELECTRONIC PROPERTIES OF MATERIALS AND DEVICES**
Nature of the electron, energy level, crystal structure, band theory and semi-conductor statistics, and electronic transport processes. PN junction theory, surface effects, physics of bipolar and field effect transistors, charge-controlled devices and opto-electronic devices, dielectric and magnetic properties of solids. Prereq: Phys 505; E E 551; E E 603. 4 cr.

**620. ELECTRONICS AND INSTRUMENTATION**
For nonengineering and nonphysics students; no mathematical or engineering detail. Techniques for using electronic instruments and equipment. DC and AC circuits, electronic amplifiers, grounding and shielding problems, transducers, electronic instruments, schematic reading, transients, noise problems, and digital techniques. Prereq: junior standing. 4 cr.

**656. ELECTROMECHANICAL DEVICES**
Theory and analysis of transformers, rotating machines, transducers and control system components, and other energy conversion methods. Prereq: E E 603; E E 542. Lab. 4 cr.

**695. ELECTRICAL ENGINEERING PROJECTS**
Laboratory or advanced study course. Students either join a department research project or engage in a project in an area of staff interest. Prereq: acceptance by staff member. 1-4 cr.

**700-level courses are offered subject to adequate student demand.**

**711. DIGITAL SYSTEMS**
Advanced switching theory techniques (design of unclocked sequential circuits, minimization of multiple output circuits, etc.) and digital design tools (L.S.I., multiplexing, etc.). Applications. Prereq: E E 531 or 543; permission. Lab. 4 cr.

**712. LOGICAL DESIGN OF DIGITAL COMPUTERS**
Computer architectures, including arithmetic, memory, control, and input-output units; the trade-offs between hardware, software, and cost. "Hands-on" laboratory experience with machine language programming, interfacing of peripherals, etc., on minicomputers and microcomputers. Prereq: E E 531 or 543; permission. Lab. 4 cr.

**714. MINICOMPUTER APPLICATIONS ENGINEERING**
Organization and operation of minicomputer-based systems. Interfacing of special purpose peripherals, data structures, control structures, program and data organization, microprogramming, real-time monitor systems. Applications to communication, automated-measurement, and process-control systems. Prereq: E E 531 or 543; programming experience; permission. Lab. 4 cr.

**727. POWER SYSTEMS**
Modeling and planning of electric power transmission systems. Prereq: E E 656; permission. 4 cr.

**741. FLUID CONTROL SYSTEMS**
Mathematical modeling of hydraulic, pneumatic, and fluidic control elements and control systems. Methods for 1) analysis of systems of using gases or liquids as the working fluid; 2) synthesis of the parameters of the control elements used in automatic control systems; 3) design of these systems. (Also offered as M E 741.) 4 cr.

**745. FUNDAMENTALS OF ACOUSTICS**
Acoustic wave equation for air; laws of reflection, refraction, and absorption; characteristics and measurement of acoustical sources; microphones; sound level; acoustical materials; ultrasonics; architectural acoustics. Prereq: Phys 408; Math 527; permission. Lab. 4 cr.

**757. FUNDAMENTALS OF COMMUNICATIONS**
Communication systems, Fourier analysis of signals, AM and FM detection, digital and sampled-data signals, noise in electrical circuits. Prereq: permission. Lab. 4 cr.

**758. COMMUNICATION SYSTEMS**
Design of high-frequency communication systems. RF amplification, modulators for AM and FM systems, receiving techniques, antennas, free-space propagation, propagation characteristics of the ionosphere. Prereq: E E 603; E E 757 or equivalent; permission. Lab. 4 cr.

**762. ILLUMINATION**
Radiation; color and spectra; physics of light production; sources of ultraviolet, visible, and infrared energy; lamp circuitry; control of light; lighting design, applications of light in business, industry, school, home, and outdoors. Open to juniors and seniors in engineering and physics. Prereq: permission. Lab. 4 cr.

**775. APPLICATIONS OF INTEGRATED CIRCUITS**
Design and construction of linear and nonlinear electronic circuits using existing integrated circuits. Use of operational amplifiers. Laboratory course in practical applications of nondigital integrated circuit devices. Prereq: permission. 4 cr.

**781. OCEAN INSTRUMENTATION PROJECT**
Interdisciplinary solution of a real-world problem; measurements of physical, chemical, or biological parameters in an ocean or freshwater environment. Student team formulates system specifications, assembles components, and designs a test procedure for demonstrating the feasibility of the prototype system. Written final report and oral demonstration before a panel of invited experts. Prereq: senior standing in engineering; permission. 4 cr.

**782. CONTROL SYSTEMS**
Fundamental principles involved in the design and analysis of feedback control systems. Topics include stability criterion, time-domain analysis, frequency-domain analysis, and introduction to nonlinear systems. Prereq: permission. Lab. (Also offered as M E 782.) 4 cr.

**783. BIOMEDICAL ENGINEERING**
Engineering applied to cardiovascular, renal, gastrointestinal, sensory, reproductive, and other organ systems. Design and utilization of diagnostic, monitoring, and prosthetic techniques and devices. Prereq: permission. Lab. 4 cr.

**784. BIOMEDICAL INSTRUMENTATION**
Principles of physiological and biological instrumentation design including transducers, signal conditioning, recording equipment, and patient safety. Laboratory includes the design and use of instrumentation for monitoring of electrocardiogram, electromyogram, electroencephalogram, pulse and temperature. Current research topics, such as biotelemetry, ultrasonic diagnosis, and computer applications. Prereq: permission. Lab. 4 cr.

**785. UNDERWATER ACOUSTICS**
Vibrations, propagation, reflection, scattering, reverberation, attenuation, sonar equations, ray and mode theory, radiation of sound, transducers, and small- and large-signal considerations. Prereq: permission. 4 cr.

**786. INTRODUCTION TO RADIO ASTRONOMY**
Electromagnetic radiation, propagation. Positional astronomy and the radio sky, discrete radio sources, source-structure distribution, the sun as a radio source, flare and burst activity, planetary emissions, quasars, pulsars, techniques of observation and data reduction, radiometry, polarimeters, correlation interferometers, aperture synthesis; Prereq: senior or graduate status in engineering and physical sciences; permission. 4 cr.

**796. SPECIAL TOPICS IN ELECTRICAL ENGINEERING**
New or specialized courses and/or independent study. Prereq: permission. 2 or 4 cr.

# Engineering Technology (E T)

**Program Director:** Donald W. Melvin

**Assistant Professor:** Kenneth Burt, electrical engineering technology
**Instructor:** T. Antero Parssinen, mechanical engineering technology
**Lecturer:** Wayne Lundblad, mechanical engineering technology

**Permission of instructor is a prerequisite to all Engineering Technology courses.**

**633. INDUSTRIAL ORGANIZATION AND LAW**
Corporations; partnerships; product liability; contracts; O.S.H.A. and safety codes; collective bargaining; types of compensation; agencies; small claims. 4 cr.

**634. ECONOMICS OF BUSINESS ACTIVITIES**
Elementary financial accounting; compound interest and time value of money; sources of capital; budgeting of resources; depreciation; risk and insurance; marketing and sales. 4 cr.

**637. HEAT AND FLUID POWER I**
Topics covered will include work and heat, first and second laws of thermodynamics, entropy, chemical reactions, heat engines and refrigerators. These concepts will be applied to various cycles (i.e., powerplants, turbines, jet engines, etc.). Field trips. Lab. 4 cr.

**638. HEAT AND FLUID POWER II**
A continuation of 637 for MET students only. Further intensive applications of thermodynamics. Additional topics will include heat transfer and fluid dynamics. Lab. 4 cr.

**641. PRODUCTION SYSTEMS**
Production standards—sources, uses; manufacturing capacity—design, analysis; manufacturing inventories and their control; production scheduling; production control. 4 cr.

**644. MET CONCEPTS IN DESIGN AND ANALYSIS**
Topics will include kinematics, kinetics, work and energy and vibrations. Intensive application of these concepts to problems in machine design. 4 cr.

**651. MECHANICAL ENGINEERING TECHNOLOGY PROJECT**
Group project; students required to find solutions to actual technological problems in design, fabrication, and testing as posed by industry. Student team defines the problem, prepares a budget, and works with the client company to research, design, build, and test the software and/or hardware needed. A year-long course: 4 cr. each semester, 8 cr. total, an "IA" grade (continuous course) given at the end of first semester. Withdrawal from course results in loss of credit.

**671. INDUSTRIAL ELECTRONICS**
Switching circuits, thyristors, SCRs, VCOs, UJTs, IC voltage regulators, IC timers and CMOS Digital Circuits; emphasis on lab experiments. Lab. 4 cr.

**674. CONTROL SYSTEMS AND COMPONENTS**
Feedback, principles; stability, Nyguist criteria; performance charts; introduction to equalizer design; control system components. Analog computer simulations. Lab. 4 cr.

**675. ELECTRICAL TECHNOLOGY I**
Electrical circuits—DC and AC; polyphase circuits; transformers; DC and AC machinery and their control; physical principles of electronic devices. Lab. 4 cr.

**676. ELECTRICAL TECHNOLOGY II**
Equivalent circuits of electronic devices; power supplies; transistor amplifiers—frequency response; introduction to digital electronics; transducers and instrumentation systems. Lab. 4 cr.

**677. INTEGRATED ELECTRONICS**
Op Amp specifications, instrumentation and bridge amplifiers, advanced Op Amp circuits and linear ICs. Lab applications. Lab. 4 cr.

**680. COMMUNICATIONS AND FIELDS**
Modulation and demodulation; noise, filter design, active filters and phase-lock loops; electric and magnetic fields; transmission lines; waveguide principles and components; antennas and radiation. Lab. 4 cr.

**690. DIGITAL SYSTEMS AND MICROPROCESSORS**
Digital circuits, memory, and number systems; their applications to digital computer systems. Microprocessors; their operation, programming, interfacing, and various uses. Microcomputer applications, supplemented with lab work. A microprocessor-based lab project is required. Lab. 4 cr.

**691. ELECTRICAL ENGINEERING TECHNOLOGY PROJECT**
Group project; students are required to find solutions to actual technological problems in design, fabrication, and testing, as posed by industry. Student team defines the problem, prepares a budget, and works with the client company to research, design, build, and test the software and/or hardware needed. A year-long course: 4 cr. each semester, 8 cr. total, an "IA" grade (continuous course) given at end of first semester. Withdrawal from course results in loss of credit.

**695. INDEPENDENT STUDY**
A) Topics in Engineering Technology Mathematics; B) Topics in Mechanical Engineering Technology; C) Topics in Electrical Engineering Technology. 1-4 cr.

# English (Engl)

**Chairperson:** Jean E. Kennard

**Professors:** Sylvester H. Bingham, emeritus; Max S. Maynard, emeritus; Robert G. Webster, emeritus; Thomas A. Carnicelli, Carl Dawson, Lewis C. Goffe, Robert Hapgood, Jean E. Kennard, Edmund G. Miller, Donald M. Murray, Philip L. Nicoloff, John C. Richardson, Mark R. Smith, Thomas A. Williams, Jr., John A. Yount
**Associate Professors:** Michael V. DePorte, Karl C. Diller, Elizabeth H. Hageman, Annette Kolodny, Gary H. Lindberg, Terence P. Logan, Andrew H. Merton, Susan Schibanoff, Charles D. Simic
**Visiting Associate Professor:** Tashio Saito
**Assistant Professors:** Mary M. Clark, Lester A. Fisher, Melody G. Graulich, Carol Muske, Thomas R. Newkirk, Hugh M. Potter, David V. Siddall, David H. Watters, Ronald A. Winslow, Jr.
**Lecturer:** Josephine Donovan

**See departmental brochure for detailed descriptions of course offerings.**

**English 401 is a prerequisite for all English courses but 301 and 302.**

**301. IMPROVEMENT IN WRITING**
Required of all students whose attainments in the fundamentals of English are found to be unsatisfactory. 0 cr. Cr/F. (Not offered every year.)

**302. IMPROVEMENT IN READING**
Intensive drill in reading skills for six weeks. 0 cr. Cr/F. (Not offered every year.)

**400. ENGLISH AS A SECOND LANGUAGE**
A course to improve the competence of foreign students in listening comprehension, speaking, reading, and writing. Recommended as preparation for Engl 401. Prereq: student should meet with and have the permission of the instructor. 4 cr.

**401. FRESHMAN ENGLISH**
Training to write more skillfully and to read with more appreciation and discernment. Frequent individual conferences for every student. 4 cr.

**402. FRESHMAN SEMINARS—APPROACHES TO LITERATURE**
Intensive study of a specific topic, theme, genre, major figure, or period of English or American literature. *No credit toward the English major.* For details, see the course descriptions available in the department office and from freshman advisers. 4 cr. (Not offered every year.)

**501. INTRODUCTION TO PROSE WRITING**
Nonfiction writing; weekly papers and frequent conferences. May be repeated for credit with the approval of department chairperson. 4 cr.

**505. INTRODUCTION TO LINGUISTICS**
Language as one of the most important human phenomena. Use and misuse of language for social communication and for verbal arts. Dialects, slang, language change, language acquisition, language and thought. Introduction to scientific methodology of linguistics and modern grammar (phonology, syntax, semantics). Relationships of language to the humanities, psychology, and sociology. (Also offered as Ling 505.) 4 cr.

**512. INTRODUCTION TO AMERICAN LITERATURE**
Works of major American writers from Irving to Faulkner, with emphasis on how to adapt and present the material to high school English classes. Open only to English teaching majors. 4 cr. (Not offered every year.)

**513, 514. INTRODUCTION TO ENGLISH LITERATURE**
Selected classic works in poetry and prose considered in chronological order and historical context. Attention to the works and to the ideas and tastes of their periods. 513: Beowulf through 18th century. 514: 1800 to the present. 4 cr.

**515, 516. A SURVEY OF AMERICAN LITERATURE**
515: From the beginning of American literature to the Civil War. 516: from the Civil War to the present. 4 cr.

**518. THE BIBLE AS LITERATURE**
Literature of the Old and New Testaments and the Apocrypha, primarily in the King James version. 4 cr.

**519. INTRODUCTION TO CRITICAL ANALYSIS**
Critical analysis of fiction, poetry, and drama. Frequent short papers. Required of all English majors; should be taken early in their programs. 4 cr.

**520. LITERATURE AND THE HISTORY OF IDEAS**
An interdisciplinary study of literary works as influenced and illuminated by the concepts of philosophers, historians, and scientists. Barring duplication of subject, may be repeated for credit. 4 cr.

**521. THE NATURE WRITERS**
Fiction, poetry, and nonfiction books on the natural environment. Such books as Thoreau's *Walden* or *Maine Woods*, Leopold's *Sand County Almanac*, Beston's *Outermost House*, Dillard's *Pilgrim at Tinker Creek*, books by naturalists who observe nature vividly and knowingly and who write out of their concern for the environment. 4 cr.

**522. AMERICAN LITERARY FOLKLORE**
Folktales, songs, proverbs, beliefs, superstitions, and their use by such American authors as Irving, Hawthorne, Longfellow, Melville, Thoreau, Twain, Frost, and Faulkner; some emphasis on oral folk culture of New Hampshire. 4 cr.

**523. MADNESS IN LITERATURE**
How various writers depict insanity, and how they approach the problem of determining what attitudes and what behavior are truly sane. Emphasis on 19th- and 20th-century works, but works from earlier periods also considered. Euripedes' The *Bacchae*, Shakespeare's *King Lear*, Cervanets' *Don Quixote*, Hoffman's *The Golden Pot*, Dostoyevsky's *Notes from the Underground*, Robbe-Grillet's *The Voyeur*, and Nabokov's *Pale Fire*. 4 cr.

**525. POPULAR CULTURE IN AMERICA**
Cultural expression in popular media. Verbal arts (best sellers, magazines, newspapers, speeches); some attention to television, film, comics, popular music. The multidisciplinary approach deals with historical context, cultural institutions, and distinctions between "popular arts" and "great literature." Recurrent images, situations, and themes will be investigated to see what values are celebrated and fears revealed. 4 cr.

**530. INTRODUCTION TO POETRY**
Twentieth-century American and British poetry. Various poetic techniques and their demonstration. 4 cr.

**531. INTRODUCTION TO DRAMA**
Nature and types of drama illustrated by major English, American, and (translated) European plays. How to read a play. Live and filmed performances studied as available. 4 cr.

**532. INTRODUCTION TO FICTION**
Modern novels and/or short stories. The ways in which fiction communicates its meanings; the tools and methods at the fiction writer's disposal, primarily as they function in individual works. 4 cr.

**533. INTRODUCTION TO FILM**
Film: history, techniques, and social relevance; as an art form. Comparison of film to drama and the novel. Showing and examination of works by such film makers as Bergman, Fellini, Truffaut, Kurosawa, Hitchcock, and Welles. 4 cr.

**585. INTRODUCTION TO WOMEN IN LITERATURE**
Survey of images of women in literature. Content and approach vary depending on instructor. 4 cr.

**586. INTRODUCTION TO WOMEN WRITERS**
Survey of women writers. Content and approach vary depending on instructor. 4 cr.

**595. LITERARY TOPICS**
Various faculty members investigate topics of special interest at a level appropriate for nonmajors. See department for details of current offerings. 4 cr.

**619. CRITICAL APPROACHES TO LITERATURE**
Selected methods of literary criticism applied to fiction, poetry, and/or drama with critical approaches varying from year to year. A follow-up of 519, course provides a second semester of training in critical reading and writing, examining such major modern strategies as formalist, biographical, archetypal, psychological, sociological, historical, feminist, and structuralist criticism. Prereq: Engl 519 or equivalent. 4 cr.

**621, 622. NEWSWRITING**
Workshops to develop reporting and writing skills. Prereq: Engl 501 or equivalent; written permission. May be repeated for credit with approval of the department chairperson. 4 cr.

**625, 626. WRITING FICTION**
A workshop in the fundamental techniques of fiction writing. Student work is criticized by fellow students; individual conferences with instructor. Prereq: Engl 501 or equivalent. Written permission of instructor required for registration. May be repeated for credit with the approval of the department chairperson. 4 cr.

**627, 628. WRITING POETRY**
A workshop in the fundamental techniques of poetry writing. Class discussion and criticism of poems written by students. Individual conferences with instructor. Prereq: Engl 501 or equivalent. Written permission of instructor required for registration. May be repeated for credit with the approval of the department chairperson. 4 cr.

**651, 652. COMPARATIVE LITERATURE**
Comparative studies of major authors representative of important periods of world literary achievement. 651: Homer to Dante; common themes and the development of the epic tradition in early Western literature. 652: Renaissance to modern. Topics and approaches vary from semester to semester. 4 cr.

**657. SHAKESPEARE**
Ten major plays representative of the main periods of Shakespeare's career and the main types of drama which he wrote (tragedy, comedy, history). Live and filmed performances included as available. Restricted to undergraduates and designed for both English majors and other students. 4 cr.

**685. WOMEN'S LITERARY TRADITIONS**
Intensive study of theme, topics, and techniques in women's literature. Topics vary from year to year. 4 cr.

**690. INTRODUCTION TO BLACK LITERATURE IN AMERICA**
Selected prose, fiction, drama, and poetry. Individual works and historical-cultural background. Course will vary from year to year. 4 cr.

**695, 696. SENIOR HONORS**
Open to senior English majors who, in the opinion of the department, have demonstrated the capacity to do superior work; permission required. May be counted as two courses toward the ten which constitute a major in English. 4 cr. (Not offered every year.)

**697, 898. SENIOR SEMINARS**
Intensive study of specialized topics which vary from year to year. Enrollment in each seminar is limited to 15 so that all students can take an active part in discussion and work closely with the instructor on their papers. Exceptional sophomores and juniors may be admitted with permission of the instructor. For details, see the course description available in the department office. 4 cr. (Not offered every year.)

**701, 702. ADVANCED WRITING OF FICTION**
Workshop discussion of advanced writing problems and readings of students' fiction. Individual conferences with instructor. Prereq: 625, 626 or equivalent. Written permission of instructor required for registration. May be repeated for credit with the approval of the department chairperson. 4 cr.

**703, 704. ADVANCED NONFICTION WRITING**
A workshop course for students intending to write publishable magazine articles or nonfiction books. Equal stress on research and writing techniques. Prereq: Engl 621; 622 recommended. Written permission of instructor required. May be repeated for credit with the approval of the department chairperson. 4 cr.

**705, 706. ADVANCED WRITING OF POETRY**
Workshop discussion of advanced writing problems and submitted poems. Individual conferences with instructor. Prereq: Engl 627, 628, or equivalent. Written permission of instructor required for registration. May be repeated for credit with the approval of the department chairperson. 4 cr.

**707. FORM AND THEORY OF FICTION**
A writer's view of the forms, techniques, and theories of fiction. The novels, short stories, and works of criticism studied will vary, depending on the instructor. 4 cr.

**708. FORM AND THEORY OF NONFICTION**
A writer's view of contemporary nonfiction, emphasizing the choices the writer faces in the process of research and writing. 4 cr. (Not offered every year.)

**709. FORM AND THEORY OF POETRY**
A writer's view of the problems, traditions, and structures of poetry. 4 cr.

**710. TEACHING WRITING**
An introduction to various methods of teaching writing. Combines a review of theories, methods, and texts with direct observation of teaching practice. 4 cr.

**712. CRITICAL ANALYSIS OF EXPOSITION**
For the English teaching major; students analyze essays and write nonfiction prose. Variety of critical approaches; several methods of teaching composition. 4 cr. (Not offered every year.)

**713, 714. LITERARY CRITICISM**
Major critics from Plato to the present; the chief critical approaches to literature. 4 cr. (Not offered every year.)

**715. APPLIED LINGUISTICS**
Methods of teaching and learning foreign languages; background work on theories of language acquisition; the methodology of teaching English as a second language. Students interested in teaching other languages may do their projects on those languages. 4 cr.

**716. PROBLEMS IN APPLIED LINGUISTICS**
Variable topics course; problems such as language acquisition in children and adults, bilingualism, and linguistic field methods. 4 cr. (Not offered every year.)

**718. ENGLISH LINGUISTICS**
Introduction to the study of language; dialects and social and psychological problems of language; intensive work on the techniques of modern grammar (syntax, phonology, semantics). 4 cr. (Not offered every year.)

**719. ENGLISH GRAMMAR**
Traditional and contemporary approaches to the study of the structure of the English language: its history, phonology, morphology, and syntax including consideration of parts of speech, phrases, clauses, sentences, etymology, punctuation. Some emphasis on the teaching of English grammar. 4 cr.

**720. NEWSPAPER INTERNSHIP**
Students intending to pursue careers in journalism spend a semester working full- or part-time for a daily newspaper under close supervision of editors. Reporting is stressed, but students may do some editing as well. The number of internships is very limited. Prereq: Engl 621 or its equivalent; permission. 4-16 cr.

**741. LITERATURE OF EARLY AMERICA**
Prose and poetry of the periods of exploration, colonization, early nationalism, Puritanism, Enlightenment. Individual works and historical-cultural background. 4 cr. (Not offered every year.)

**742. AMERICAN LITERATURE, 1815-1865**
Fiction, nonfiction, and poetry in the period of romanticism, transcendentalism, nationalism. Individual works and cultural background. 4 cr. (Not offered every year.)

**743. AMERICAN LITERATURE, 1865-1915**
Fiction, nonfiction, and poetry in the period of realism, naturalism, industrialism, big money. Individual works and cultural background. 4 cr.

**744. AMERICAN LITERATURE, 1915-1945**
Fiction, poetry, and drama in the period of avant-garde and leftism, jazz age, and depression. Individual works and cultural background. 4 cr.

**745. CONTEMPORARY AMERICAN LITERATURE**
A gathering of forms, figures, and movements since 1945. Individual works and cultural background. 4 cr.

**746. STUDIES IN AMERICAN DRAMA**
Topics vary from year to year. Examples: 20th-century American drama; contemporary playwrights; theatricality in American life. 4 cr. (Not offered every year.)

**747. STUDIES IN AMERICAN POETRY**
Topics vary from year to year. Examples: poets of the open road; Pound and his followers; major American poets; contemporary American poetry. 4 cr. (Not offered every year.)

**748. STUDIES IN AMERICAN FICTION**
Topics vary from year to year. Examples: the romance in America; the short story, realism and naturalism; the city novel; fiction of the thirties. 4 cr.

**749. MAJOR AMERICAN AUTHORS**
Intensive study of two or three writers. Examples: Melville and Faulkner; Fuller, Emerson, and Thoreau; James and Wharton; Dickinson and Frost. 4 cr.

**750. SPECIAL STUDIES IN AMERICAN LITERATURE**
Topics vary from year to year. Examples: the Puritan heritage; ethnic literatures in America; landscape in American literature; five American lives; pragmatism; American humor; transcendentalism; women regionalists. 4 cr.

**751. MEDIEVAL EPIC AND ROMANCE**
The two major types of medieval narrative; comparative study of works from England, France, Germany, and Iceland, including *Beowulf, Song of Roland, Niebelungenlied,* Gottfried's *Tristan, Njal's Saga,* and Malory's *Morte d'Arthur.* All works read in modern English translations. 4 cr. (Not offered every year.)

**752. HISTORY OF THE ENGLISH LANGUAGE**
Evolution of English from the Anglo-Saxon period to the present day. Relations between linguistic change and literary style. 4 cr. (Not offered every year.)

**753. OLD ENGLISH**
Introduction to Old English language and literature through the readings of selected poetry and prose. 4 cr.

**754. BEOWULF**
A reading of the poem and an introduction to the scholarship. Prereq: Engl 753. 4 cr.

**755, 756. CHAUCER**
755: *Troilus and Criseyde,* in the context of medieval continental literature by Boccaccio and other influences. 756: *The Canterbury Tales.* 4 cr.

**758. SHAKESPEARE**
A few plays studied intensively. Live and filmed performances included as available. 4 cr.

**759. MILTON**
Milton and his age. Generous selection of Milton's prose and poetry, with secondary readings of his sources and contemporaries. 4 cr. (Not offered every year.)

**763. CONTINENTAL BACKGROUNDS OF THE ENGLISH RENAISSANCE**
Major philosophers, artists, and writers of the continental Renaissance (in translation): Petrarch, Ficino, Pico, Vives, Valla, Castiglione, Machiavelli, Luther, Calvin, Rabelais, Montaigne, Cervantes, Erasmus, and Thomas More, as representative of the early English Renaissance. 4 cr. (Not offered every year.)

**764. PROSE AND POETRY OF THE ELIZABETHANS**
Shakespeare and his contemporaries. Major works, including Spenser's *Fairie Queene,* Sidney's *Astrophil and Stella,* Shakespeare's *Sonnets;* Marlowe's *Dr. Faustus*: their literary and intellectual backgrounds. 4 cr. (Not offered every year.)

**765. ENGLISH LITERATURE IN THE 17th CENTURY**
Major writers of the 17th century, including Donne, Jonson, Herbert, Bacon, and Hobbes. 4 cr. (Not offered every year.)

**767, 768. LITERATURE OF THE RESTORATION AND 18th CENTURY**
Representative works; text studied closely; the ways they reflect the central intellectual problems of their age. 767: Dryden, Rochester, Restoration plays, Bunyan, Defoe, Montesquieu, and Swift. 768: Pope, Fielding, Johnson, Boswell, Voltaire, Sterne, Rousseau, Beckford, Diderot, and Blake. 4 cr.

**769, 770. THE ENGLISH ROMANTIC PERIOD**
Major literary trends and authors, 1798 to 1832. Focus on poetry but attention also to prose works and critical theories. 769: Wordsworth, Coleridge, Lamb, Hazlett, DeQuincey; 770: Byron, Shelley, Keats. 4 cr. (Not offered every year.)

**771, 772. VICTORIAN PROSE AND POETRY**
Major writers; social and cultural history. Typically included in 771, Carlyle, Ruskin, Newman, Tennyson, Browning, and others; in 772, Arnold, the pre-Raphaelites, Swinburne, Hopkins, and others. 4 cr. (Not offered every year.)

**773, 774. BRITISH LITERATURE OF THE 20th CENTURY**
Poets and novelists; the concept of modernity in literature. Offerings vary by year and by instructor, but normally include such figures as Joyce, Lawrence, Yeats, Woolf, Forster, and more contemporary writers such as Burgess, Fowles, Murdoch, and Golding. 4 cr.

**775. IRISH LITERATURE**
Survey from the beginnings to the present; works in Irish (read in translation) such as *The Cattle Raid of Cooley,* medieval lyrics, and *Mad Sweeney*; and works in English from Swift to the present. Twentieth-century authors: Joyce, Yeats, Synge, O'Casey, Beckett, and Flann O'Brien. 4 cr. (Not offered every year.)

**778. BRAIN AND LANGUAGE**
An introduction to neurolinguistics, a study of how language is related to the structure of the brain. The biological foundations of linguistic universals and language acquisition. Examination of evidence from aphasia and from normal language use. 4 cr.

**779. LINGUISTIC FIELD METHODS**
Devoted to the study, with use of an informant, of some non-Indo-European language that is unfamiliar to both the students and the instructor at the beginning of the class. The primary aim of the course is to give students a practical introduction to linguistic analysis without the support of a text. Theoretical concepts will be introduced as needed. 4 cr.

**781. ENGLISH DRAMA TO 1800**
Development from the Middle Ages through the 18th century, emphasizing the Elizabethan-Jacobean contemporaries of Shakespeare (Marlowe, Jonson, Webster). Selected plays from the middle ages, the Restoration period, and the 18th century. 4 cr. (Not offered every year.)

**782. MODERN DRAMA**
Major English, American, and (translated) European plays of the modern period by such playwrights as Shaw, Ibsen, Chekhov, Strindberg, Pirandello, O'Neill, Brecht, Beckett, Williams, Miller, Pinter. Live and filmed performances studied as available. 4 cr. (Not offered every year.)

**783. THE ENGLISH NOVEL OF THE 18th CENTURY**
The rise and development of the novel through study of selected major works by Defoe, Richardson, Fielding, Smollett, Sterne, and Austen. 4 cr.

**784. THE ENGLISH NOVEL OF THE 19th CENTURY**
Representative novels from among Austen, Scott, Dickens, Thackeray, Emily Brontë, Charlotte Brontë, Trollope, George Eliot, Hardy, and Conrad. 4 cr.

**785. MAJOR WOMEN WRITERS**
Intensive study of one or more women writers. Selections vary from year to year. 4 cr.

**790. SPECIAL TOPICS IN LINGUISTIC THEORY**
An advanced course on a topic to be chosen by the instructor. Inquire at the English Department office for a full course description each time the course is offered. Topics such as Dialectology, Montague Grammar, African Linguistics, Linguistics and Literature, Metrics, Cross-disciplinary studies relating to linguistics. Barring duplication of subject, may be repeated for credit. 4 cr.

**791-792. ENGLISH EDUCATION—PROBLEMS IN THE TEACHING OF HIGH SCHOOL ENGLISH**
Methods and techniques in teaching language, composition, and literature in grades 7-12. Required of all students in the English teaching major. Open to others with permission. No credit toward the English major. 2 cr.

**793. PHONETICS AND PHONOLOGY**
The sounds and sound systems of English in the context of linguistic theory: comparisons of English to other languages. Prereq: a basic linguistic course or permission. 4 cr. (Not offered every year.)

**794. SYNTAX AND SEMANTIC THEORY**
The relationship of grammar and meaning as viewed from the standpoint of modern linguistic theory. Emphasis on the syntax and semantics of English, with special attention to the construction of arguments for or against particular analyses. Prereq: a basic linguistic course or permission. 4 cr.

**795, 796. INDEPENDENT STUDY**
Open to highly qualified juniors and seniors. To be elected only with permission of the department chairperson and of the supervising faculty member or members. Barring duplication of subject, may be repeated for credit up to a maximum of 16 credits. 1-16 cr.

**797, 798. SPECIAL STUDIES IN LITERATURE**
A) Old English Literature; B) Medieval Literature; C) The Renaissance; D) 17th Century; E) 18th Century; F) English Romantic Period; G) Victorian Period; H) 20th Century; I) Drama; J) Novel; K) Poetry; L) Nonfiction; M) American Literature; N) A Literary Problem. The precise topics and methods of each section will vary. Barring duplication of subject, may be repeated for credit. For details, see the course descriptions available in the English department. 4 cr.

# Entomology (Ento)

**Chairperson:** G. Thomas Fisher

**Professors:** James G. Conklin, emeritus; Robert L. Blickle
**Associate Professors:** James S. Bowman, G. Thomas Fisher, R. Marcel Reeves
**Assistant Professor:** John F. Burger

**400. INSECTS: THEIR ROLE AS MAN'S GREATEST COMPETITOR**
Insects and their relations to man, his environment, and his activities. Not for major credit. Mr. Fisher. 3 cr.

**402. INTRODUCTORY ENTOMOLOGY**
Insect structure and function, development, classification, ecology, behavior, and evolution, for students in the biological sciences; importance of insects in terrestrial and aquatic ecosystems; their ability to survive and reproduce. Insect collection required. Mr. Burger. Lab. 4 cr.

**503. PRINCIPLES OF APPLIED ENTOMOLOGY**
Nature of destructive and beneficial insects and the fundamentals of insect pest management in our modern society. Elective for sophs., jrs., srs. Mr. Bowman. 4 cr.

**506. FOREST ENTOMOLOGY**
Especially for forest resources majors. Structure, development, classification, and control of representative forest insects. Insect collection required. Mr. Reeves. Lab. 4 cr.

**695. PROBLEMS IN ENTOMOLOGY**
Problems and independent investigations in the various fields of basic and applied entomology. Prereq: Ento 402 and 503; permission. Staff. 2-4 cr.

**704. MEDICAL ENTOMOLOGY**
Especially for students interested in public health or medicine. Insects and arachnids in relation to public health; the biology and control of important disease carriers. Elective for juniors and seniors. Mr. Blickle. Lab. 4 cr.

**705. TAXONOMY OF INSECTS**
Concepts, history, procedure, nomenclature, and use, as applied to a selected taxon. Prereq: permission. Mr. Blickle. 4 cr.

**706. SOIL ARTHROPODS**
Biology and systematics of terrestrial arthropods, with emphasis on the springtails, sowbugs, myriopods, mites, spiders, and other arachnids. Prereq: permission. Mr. Reeves. Lab. 4 cr.

**707. IMMATURE INSECTS**
Identification of immature stages of insects, especially of holometabolus orders. Aquatic forms not included. Morphological features necessary for determination. Prereq: permission. Mr. Blickle. 4 cr.

**708. INSECT MORPHOLOGY**
External and internal anatomy of insects. Prereq: permission. Mr. Blickle. 4 cr.

**709. AQUATIC INSECTS**
Identification and biology of aquatic forms of insects. Prereq: permission. Mr. Blickle. 4 cr.

**710. INSECT PHYSIOLOGY**
Advanced study of the insect organs and their functions. Prereq: permission. Staff. 4 cr.

**720. AGRICULTURAL ENTOMOLOGY**
For advanced students interested in agribusiness. Economic insect pests on forage, fruit, and vegetable crops. Life cycles; damage and current methods of control. Prereq: permission. Mr. Fisher. Lab. 4 cr.

**721. PRINCIPLES OF BIOLOGICAL CONTROL**
Natural and applied aspects of biological control of insect and plant pests. Prereq: permission. Mr. Reeves. 4 cr. (Not offered every year.)

**722. CHEMICAL CONTROL OF INSECTS**
For advanced students in applied entomology. Review of the chemical compounds for insect control. Modes of pesticide entry; toxicology. Basic understanding of chemistry is desired. Prereq: permission. Mr. Fisher. Lab. 4 cr.

**723. REGULATORY PEST CONTROL**
For students preparing for careers dealing directly with or associated with the movement of agricultural commodities in internal and foreign trade. Legal documents; federal and state statutes. Prereq: basic entomology and plant pathology courses; permission. Mr. Mason. 2 or 4 cr. (Not offered every year.)

**724. STRUCTURAL PEST CONTROL**
For students wishing to study household and industrial entomology. Prereq: permission. Mr. Fisher. Lab. 4 cr.

## Environmental Conservation

(See Institute of Natural and Environmental Resources)

## Environmental Engineering

(See pages 56, 59, and 62)

## Forest Resources

(See Institute of Natural and Environmental Resources)

## French

(See Ancient and Modern Languages and Literatures)

## Geography (Geog)

**Chairperson:** William H. Wallace

**Professor:** William H. Wallace
**Associate Professor:** Robert G. LeBlanc
**Assistant Professor:** Robert L. A. Adams
**Adjunct Assistant Professor:** James W. Cerny
**Lecturer:** Alasdair D. Drysdale

**401, 402. REGIONAL GEOGRAPHY OF THE WORLD**
Major culture areas of the world and the unique integration of human and physical phenomena that produce the distinctive character of these areas. 401: Western culture areas—Europe, the Americas, Australia, and New Zealand. 402: Non-Western culture areas—Black Africa, the Dry World, Oriental Asia, and the Pacific. 4 cr.

**473. THE WEATHER**
The elements and controls of weather; interpreting the nature and variability of New England weather. 4 cr.

**512. GEOGRAPHY OF CANADA**
Historical and regional geography of Canada. Historical growth; development of its distinctive regions; contemporary prospects and problems. Resource base, exploration, settlement, population growth, cultural contrasts, economic development, and special relationship with the U.S. Required 6- to 7-day field trip to Canada. 4 cr.

**513. GEOGRAPHY OF THE UNITED STATES**
Geographical diversity of the U.S.: its physical setting, historical development, and contemporary spatial organization. Distinctive character and problems of major American regions; recent changes in economic, demographic, and social conditions. 4 cr. (Not offered every year.)

**531. GEOGRAPHY OF WESTERN EUROPE AND THE MEDITERRANEAN**
A regional and topical analysis of Western Europe and the Mediterranean. Major topics include: patterns of natural phenomena, cultural features, and economic systems. 4 cr. (Not offered every year.)

**540. GEOGRAPHY OF THE MIDDLE EAST**
Environmental, cultural, political-geographic, and ecological foundations of the Middle East. Selected regional problems and issues; e.g., geographical dimensions of the Arab-Israeli conflict, oil, regional integration, economic development, urbanization, population growth, and nomadism. 4 cr.

**570. INTRODUCTORY CLIMATOLOGY**
Characteristics and world distribution of present climates. Climates of the past and theories of climatic change. Human adjustment to and modification of climate. 4 cr.

**573. PHYSICAL GEOGRAPHY**
Factors in the formation and distribution of landforms, soils, and vegetation. Human significance of nature. Lab. 4 cr. (Not offered every year.)

**581. CULTURAL GEOGRAPHY**
Differentiation of the world in terms of population, race, language, religion, and economy. Historical origin and diffusion of these phenomena. 4 cr. (Not offered every year.)

**582. ECONOMIC GEOGRAPHY**
Areal variation of the earth in terms of production, exchange, and consumption of economic goods. Development and application of various theories of location. (Not offered every year.) 4 cr.

**583. URBAN GEOGRAPHY**
The city: spatial structure and geographical characteristics. Emphasis on the North American city and its problems: land use patterns, zoning, political fragmentation, urban physical environment, residential and occupational patterns, crime and justice, and health care delivery. 4 cr.

**590. INTRODUCTORY CARTOGRAPHY**
Map usage, design, and execution; special-purpose thematic maps used in scholarly papers, theses, journals, and books. 4 cr.

**610. THE GEOGRAPHY OF NEW ENGLAND**
Distinctive physical setting of New England; its settlement and development during the past three centuries, and present-day problems and opportunities of the region. Three required weekend field excursions near the end of the term. Prereq: permission. 4 cr. (Not offered every year.)

**683. HISTORICAL GEOGRAPHY OF THE UNITED STATES**
Spatial analysis of Indian economic life in 1492 and of European exploration, colonization, population change, economy, urbanization, and ethnicity to 1900. Geographic illusions and their significance. 4 cr. (Not offered every year.)

**690. ADVANCED CARTOGRAPHY**
Opportunity to pursue individual interests while sharing in the work of the instructor and other students. Map symbolization, map perception, computer mapping, map projection, surface analysis. Prereq: Geog 590 or permission. 4 cr. (Not offered every year.)

**795. SPECIAL PROJECT IN GEOGRAPHY**
Readings, library, archival, and field work. Primarily for geography seniors. Prereq: permission. 2 or 4 cr.

**797. SEMINAR IN GEOGRAPHY**
Methodology and philosophy of geography. History of geographic thought, organizing concepts, and geographic analysis. Definition and investigation of research problems. Primarily for geography seniors. 4 cr. Cr/F.

## Geology

(See Earth Sciences)

## German

(See Ancient and Modern Languages and Literatures)

## Greek

(See Ancient and Modern Languages and Literatures)

# Health Administration and Planning (HAP)

**Chairperson:** David E. Berry

**Professor:** Basil J. F. Mott
**Adjunct Professor:** Wayne C. Patterson
**Associate Professor:** David E. Berry
**Adjunct Associate Professors:** Gerald Taube, Donald E. Nicoll
**Assistant Professors:** Michael J. O'Sullivan, Lee F. Seidel

**401. HEALTH CARE SYSTEMS**
Nature and functions of health care services and health professionals; impact of social, political, economic, legal, and technological forces. Current health problems. 4 cr.

**402. PUBLIC HEALTH AND HUMAN ECOLOGY**
Health dimension of human interaction with physical and social environments, and analysis of the problematic relationships; investigation of public health services at various levels of government. 4 cr.

**401A-402A. SEMINAR ON HEALTH AND MEDICAL CARE SYSTEMS**
Focuses on health and how interactions between physical and social environment affect health; nature and function of medical care and public health services including impact of social, political, economic, legal, and technical forces. (Not open to students who have completed either HAP 401 or HAP 402.) 8 cr.

**502. HEALTH AND MEDICAL CONCEPTS**
Language and methodologies used by health clinicians in the prevention and treatment of disease. Efficacy of alternative interventions. Prereq: major; Biol 401 or permission. 4 cr.

**600. SPECIAL TOPICS**
Formal courses given on topical or special-interest subjects. Several topics may be taught in one year or semester. Prereq: junior standing in major or permission. 1-4 cr.

**601. ADMINISTRATIVE PROBLEMS IN HEALTH ORGANIZATIONS**
Means for improving administrative capacity of health organizations; application and analysis of various administrative processes and techniques in a health context. Prereq: major or permission. 4 cr.

**602. HEALTH ADMINISTRATION AND PLANNING: FIELD PRACTICUM**
Work experience in a hospital, nursing home, neighborhood health center, health-planning agency, or other health organization. Application of theories to practice. Supervision by agency personnel. Prereq: major or permission. Coreq: HAP 603. 10 cr.

**603. HEALTH ADMINISTRATION AND PLANNING: POST-PRACTICUM SEMINAR**
Analysis of a student's field experience and critique by classmates. Prereq: major or permission. Coreq: HAP 602. 2 cr.

**611. HEALTH AND SOCIAL PLANNING**
Issues and theoretical foundations common to health- and human-services planning; evolution of health planning, current organizational patterns, planning strategies, and plan development. Prereq: major or permission. 4 cr.

**695. INDEPENDENT STUDY**
In-depth study with faculty supervision. Prereq: permission of major adviser and faculty of the area concerned. 2-4 cr.

**700. HEALTH ADMINISTRATION AND PLANNING: COMPETENCY ASSESSMENT**
Examination and/or evaluation to determine level of competency within the five program competency areas. Normally students will be granted up to 12 credits each for competencies 1-4 (generic areas) and up to 16 credits for competency 5 (area of specialized interest). Prereq: major and permission. An instructor may assign an "IA" grade (continuing course) at end of one semester. 0-64 cr. Cr/F.

**701. HEALTH POLICY AND PROGRAM ANALYSIS**
Applied health planning and administrative techniques. Prereq: major or permission. 4 cr.

**702. HEALTH AND HUMAN SERVICES—INTERORGANIZATIONAL RELATIONSHIPS**
Complex health problems and interorganizational response. Theories for evaluating and designing interorganizational systems. Prereq: major or permission. 4 cr.

**704. FINANCIAL MANAGEMENT OF HEALTH-CARE INSTITUTIONS**
Techniques and issues related to the financial dimension of health administration and planning. Prereq: major or permission. 2-4 cr.

**793-794. SENIOR SEMINAR**
Semester I: Investigation of topic of interest to student and value to health administration and planning; detailed outline of senior paper developed. Semester II: Paper written and submitted; selected seminars as necessary. Prereq: senior in major. 1 cr.

# Health Studies

(See School of Health Studies)

# History (Hist)

**Chairperson:** Charles E. Clark

**Professors:** Charles E. Clark, Hans Heilbronner, Charles A. Jellison, William R. Jones, David F. Long, Darrett B. Rutman, Douglas L. Wheeler, Donald J. Wilcox
**Associate Professors:** Gibson R. Johnson, emeritus; Allan B. Partridge, emeritus; Robert C. Gilmore, Marion E. James, Allen B. Linden, Frank D. McCann, Robert M. Mennel, Marc L. Schwarz, Harvard Sitkoff, John O. Voll
**Assistant Professors:** Jeffry M. Diefendorf, Judith A. Silver

**401. PRESENT IN PERSPECTIVE**
Selected issues in contemporary life. Modern religious, cultural, and political topics from the viewpoint of the historian in an effort to see the present in a broader perspective. Western and non-Western experiences. 4 cr.

**500. INTRODUCTION TO HISTORICAL THINKING**
Basic skills essential to the study of history: critical reading of historical literature, improvement of written and oral analysis of historical material, and use of library resources. Intensive study of books and documents from varying historical fields and periods. Required of history majors; open to other interested students. 4 cr.

## Group I. American History

**503, 504. HISTORY OF THE UNITED STATES**
American history from settlement to the present. Political, social, economic, and diplomatic aspects. Not open to students who elect Hist 510. 4 cr.

**505, 506. AFRO-AMERICAN HISTORY**
Experiences, aspirations, and contributions of Black Americans from their ethnic origins in Africa to the present American crisis in race relations; comparative study of cultures and institutions. 4 cr.

**510. HISTORICAL SURVEY OF AMERICAN CIVILIZATION**
Topical survey, within broad chronological divisions, of the development of American civilization since 1600. Not open to students who elect Hist 503 or 504. 4 cr.

**511. HISTORY OF NEW HAMPSHIRE**
From presettlement times to the present, emphasizing the use of locally available materials and sources. 4 cr. (Not offered every year.)

**703. EARLY AMERICAN HISTORY**
The development of an Anglo-American society and culture along the eastern seaboard of North America, 1600-1750. 4 cr.

**705, 706. AMERICA IN THE 18th CENTURY AND THE REVOLUTION**
American colonial and revolutionary history from 1740 through the adoption of the Constitution and the establishment of Washington's first administration. 4 cr.

**711, 712. 19th-CENTURY AMERICA**
Domestic and international factors in the development of the American republic, its institutions and people, from the inception of the new nation in 1789 to the emergence of the United States as a world power in 1900. 4 cr.

**715, 716. 20th-CENTURY AMERICA**
U.S. after 1900; cultural, political, and social factors causing major changes in American life. Semester I: progressivism through the New Deal. Semester II: World War II to the present. 4 cr.

**719, 720. THE FOREIGN RELATIONS OF THE UNITED STATES**
Primarily the history of American diplomacy, with attention given to the nondiplomatic aspects. Semester I: American Revolution to 1890. Semester II: 1890 to date. 4 cr.

**721, 722. HISTORY OF AMERICAN THOUGHT**
Significant American thinkers considered in their social context. Semester I: 1600 to 1860. Semester II: 1860 to present. 4 cr. (Not offered every year.)

**724. AMERICAN URBAN HISTORY**
Urbanization process from the colonial period to the present. 4 cr.

## Group II. European History

**521. HISTORY OF SCIENCE (TO THE RENAISSANCE)**
Prehistoric techniques, Pythagoreanism and Greek rationalism, concept of the universe, neo-Platonism and the Newtonian synthesis, history of atomism. 4 cr.

**522. HISTORY OF SCIENCE (POST-RENAISSANCE)**
Idea of the past, evolution; matter, energy, light; rise and decline of classical physical science; history of relativity and the quantum theory. Prereq: Hist 521 or permission. 4 cr.

**535. MODERN EUROPEAN HISTORY**
Rise of Europe to global supremacy from the 14th to the 19th century and its transformation in the 20th century. 4 cr.

**559, 560. HISTORY OF GREAT BRITAIN**
History of Great Britain from the earliest times to the present; from social, constitutional, economic, political, and intellectual perspectives. Designed for history students as well as those interested in literature, western political and social systems, American studies, education, and prelaw. 4 cr.

**563. INTRODUCTION TO RUSSIAN CULTURE AND CIVILIZATION**
A survey course, thematically organized, drawing upon Russian and Soviet literature, history, politics, art, and ideological currents to create a composite portrait of the evolution of Russian and Soviet culture. 4 cr.

**739, 740. THREE MEDIEVAL CIVILIZATIONS**
Demise of classical antiquity in the lands bordering the Mediterranean, and the genesis and fruition of three new cultural traditions: Latin Christian, Islamic, and Byzantine. Religious, literary, and scholarly survivals and innovations from 400 A.D. to 1400 A.D. 4 cr.

**741. THE AGE OF THE RENAISSANCE**
Renaissance from 1300 to 1600, stressing intellectual and cultural history and concentrating on events in Italy; aspects of northern Europe. 4 cr.

**742. THE AGE OF REFORMATION**
Northern Europe from 1300 to 1600, stressing the intellectual and cultural aspects of the European Reformation. Concentrates on the 16th century, but important trends in the 14th and 15th centuries will be given considerable attention. 4 cr.

**747. FRANCE FROM LOUIS XIV TO THE FRENCH REVOLUTION**
Pressures and influences which led to the French Revolution. 4 cr.

**748. EUROPEAN SOCIAL CHANGE AND INDUSTRIALIZATION**
Impact of the Industrial Revolution and the French Revolution on workers, peasants, middle class, and women of England, France, and Germany in the 19th century. 4 cr.

**751, 752. EUROPEAN INTELLECTUAL HISTORY**
European intellectual tradition from the Greek philosophers to the end of World War II. How basic ideas have developed out of previous modes of thought in response to new challenges. 4 cr.

**756. 20th-CENTURY EUROPE**
World War I, European totalitarianisms, World War II, the loss of European primacy, and the search for a new Europe. 4 cr.

**759. HISTORY OF MODERN SPAIN AND PORTUGAL**
Iberian states and their peoples from the coming of liberalism to the present. Failure of Iberian liberalism and liberal government. Political and social change, imperial and intellectual movements, influences of Western European thought and activity. 4 cr.

**761, 762. ENGLAND IN THE TUDOR AND STUART PERIODS**
Political, religious, socio-economic, and intellectual forces for change at work in England from the accession of Henry VII to the revolution of 1688-89. 4 cr.

**763. RUSSIA: ORIGINS TO MODERNIZATION**
Russia from its foundation to emancipation and reform. Political developments, foreign relations, intellectual and ideological currents. 4 cr.

**764. RUSSIA: FROM TSARIST TO SOVIET EMPIRE**
The cost of modernization; Leninist and Stalinist revolutions; Soviet consolidation. 4 cr.

**767. EARLY MODERN GERMANY: REFORMATION TO THE REVOLUTION OF 1848**
Conflict between Holy Roman Empire and petty states; rise of Prussia; religious conflict and Enlightenment. 4 cr.

**768. MODERN GERMANY SINCE 1848**
Bismarck and Imperial Germany; Weimer and the rise of Hitler; post-World War II-divided Germany. 4 cr.

## Group III. Non-Western History

**501. WORLD HISTORY**
Major world civilizations; interrelationships in time and space among the different human societies. Social, cultural, and political factors of the human experience. 4 cr.

**531, 532. LATIN AMERICAN HISTORY**
Semester I: Amerindian America and the European conquest and domination down to the last half of the 18th century. Semester II: problems of identity, integration, and nationalism, with analysis directed at selected national areas (e.g., Brazil, Mexico, Argentina, and Cuba), plus attempts at generalization. 4 cr.

**575. THE ANCIENT NEAR EAST**
From the neolithic revolution to the time of Alexander the Great. Rise of civilization; nature of human artistic and intellectual development in the earliest civilizations of Mesopotamia and Egypt; Judaism in its historical setting. 4 cr.

**576. THE AGEAN WORLD**
History of Greece and the Aegean area from Crete to the time of Alexander the Great in 323 B.C. 4 cr.

**579, 580. THE HISTORY OF CHINA AND JAPAN**
Civilizations of China and Japan from their origins to the present. Semester I: traditional civilizations of China and Japan to 1800. Semester II: the modernization of China and Japan after 1800. 4 cr.

**585, 586. THE HISTORY OF THE MIDDLE EAST**
From the time of Muhammad to the present. Semester I: origins and expansion of Islam and the nature of medieval Islamic civilization. Semester II: Ottoman history, relations with European powers, and emergence of modern nations in the Middle East. 4 cr.

**587, 588. HISTORY OF AFRICA SOUTH OF THE SAHARA**
From ancient times to the present. Semester I: from prehistoric times to 1870. Semester II: from 1870 to the present. African migrations, kingdoms and societies; African responses to the slave trade; Islam: European imperialism, colonialism, and industrialization; African nationalism, independence, and postindependence problems. 4 cr.

**590. THE CITY IN HISTORY**
The preindustrial and modern city as a philosophical and cultural institution, with emphasis on city design and architecture. Certain great cities, such as Athens, Florence, Paris of 1900, and Berlin of the 1920s, will be dealt with in detail. 4 cr.

**731. LATIN AMERICAN HISTORY: REGIONAL OR COUNTRY STUDIES**
Seminar; readings and discussions of literature relative to region or country being studied. See department listing for the current semester's topic. Students will be guided through preparation of a research proposal. Hist 531, 532 recommended. 4 cr.

**732. LATIN AMERICAN HISTORY: TOPICAL STUDIES**
Thematic seminar; reading and discussions of literature relative to selected topics. See the department listing for the current semester. Students will be guided through preparation of a research proposal. Hist 531, 532 recommended. 4 cr.

**777. THE HELLENISTIC-ROMAN WORLD**
The Mediterranean and Near East from the time of Alexander to the reign of Constantine. Covers the main political and social developments, but stresses artistic, scientific, philosophical, and religious trends, with particular emphasis on the rise of Christianity, Zoroastrianism, and the general religious climate that prepared the way for Islam. 4 cr.

**781. HISTORY OF MODERN CHINA, 1839-PRESENT**
Modernization of China. Political, social, and cultural changes that have occurred in China from its early contacts with the West. 4 cr.

**784. HISTORY OF SOUTHERN AFRICA SINCE 1820**
Struggle for political and economic control in the only region of Africa where European groups remain in power. Impact of European imperialism, European-settler nationalism, racial conflict, economic competition and industrialization, apartheid, and assimilation with special attention to development of European hegemony. Official American policy. 4 cr.

**785. THE MODERN MIDDLE EAST**
From 18th century to the present. Problems created by modernization and reform of the traditional society; conservative reaction to reform, impact of nationalism, and appearance of new ideologies. 4 cr.

**787. BLACK CONSCIOUSNESS AND PROTEST**
Origins and causes of the rising consciousness and consequent activism of the peoples of Negro descent in the New World and in Africa from the early 19th century to the present. Protest literature, Black nationalism. Pan-Negroism, Pan-Africanism, negritude, the Nation of Islam, and separatist religious sects in the Americas and Africa. Crosscultural and multidisciplinary. 4 cr.

**791. RELIGION IN WORLD HISTORY**
The religious experience of man from the perspective of world history. The major modes of religion; development of the major religious traditions and institutions. 4 cr.

## Group IV. Special Courses

**595, 596. EXPLORATIONS IN HISTORY**
See department listings for semester topic. 1-4 cr.

**774. HISTORIOGRAPHY**
Analysis of ancient and modern historians. Required of all entering Ph.D. candidates, open to undergraduates with permission. 4 cr. (Not offered every year.)

**775. HISTORICAL METHODS**
Contemporary historical methods. Required of all entering Ph.D. candidates; open to undergraduates with permission. 4 cr. (Not offered every year.)

**789. SEMINAR IN THE HISTORY OF SCIENCE**
Selected topics conducted through special lectures, individual study, oral and written reports. Subject varies. Cannot be used for credit in history without permission of the department. Prereq: permission. 4 cr.

**790. QUANTIFICATION AND COMPUTERS FOR THE HISTORIAN**
The historian's use of computers and statistics; practical applications of both interactive terminal operations and batch processing. Data generation and processing, computer languages (BASIC, FORTRAN), programming and library programs, elementary statistics; students will undertake operations of their own on material supplied and will consider particular quantitative studies in history in terms of techniques used. No previous knowledge of computers or college mathematics required. Prereq: admission as an undergraduate major or graduate student in history; /or permission. 4 cr.

**795, 796. INDEPENDENT STUDY**
A) Early American History; B) American National History; C) Canada; D) Latin America; E) Medieval History; F) Early Modern Europe; G) Modern European History; H) Ancient History; I) Far East and India; J) Near East and Africa; K) European Historiography; L) American Historiography; M) Russia; N) World History; O) English History; P) New Hampshire History; Q) Historical Methodology. For students showing a special aptitude in history who desire to study an area or subject for which no appropriate course is offered. Prereq: permission. 4 or 8 cr.

**797. COLLOQUIUM IN HISTORY**
Selected topics in American, European, and non-Western history. Required of history majors. Students must select section in the department office at the time of registration. 4 cr.

# Home Economics (HEc)

**Acting Chairperson:** Mary E. Holder

**Associate Professors:** M. Elizabeth Rand, emerita; Sarah C. Thames, emerita; Mary E. Holder, Victor R. Messier, Elizabeth A. Snell
**Assistant Professors:** Larry J. Hansen, Anthony R. Tagliaferro, Sharon F. Young
**Instructors:** Jill Y. Amidon, Florence P. Hansen, Mary T. Larson, Judith A. Trujillo

**407. PROFESSIONAL SEMINAR**
Definition and clarification of professional and educational objectives in home economics. 2 cr. Cr/F.

**415. BASIC CLOTHING CONSTRUCTION**
Self-paced programmed instruction laboratory. Basic principles of clothing construction. 2 cr. Cr/F.

**418. FOOD PREPARATION**
Principles of food preparation and service; application of principles through laboratory. Prereq: HEc major. Lab fee $10. 2 cr.

**419. MEAL MANAGEMENT**
Planning, selection, and serving; management of time, money, and energy. Prereq: HEc major. Lab fee $7. 2 cr.

**506. PRINCIPLES OF NUTRITION**
Fundamental principles underlying the nutrition of humans and animals; functions of the various nutrients in the maintenance, growth, and production of the animal body, and metabolic disorders resulting from their deficiency; digestion, absorption, intermediary metabolism, and excretion of individual nutrients. Prereq: human physiology and some knowledge of organic chemistry. Lab. (Also offered as AnSc 506. ) 4 cr.

**507. INTRODUCTORY FIELD EXPERIENCE**
Supervised community experience; opportunity to explore career opportunities in nursery schools, day care centers, cooperative extension, programs for the handicapped, youth groups, schools, community and family welfare agencies, hospitals, and others. Prereq: HEc major and permission. May be repeated up to 4 credits. 2 cr.

**514. TEXTILES**
Textiles from raw materials through manufacturing and finishing. Fiber and fabric identification and properties as they relate to the consumer. Laboratory work with textile fibers and fabrics. Lab fee $5. 4 cr.

**525. HUMAN DEVELOPMENT**
Development and guidance from conception through aging. Specific observation project required. 4 cr.

**527. GUIDING CHILDREN**
Current theoretical approaches to communicating with children and influencing their behavior. Weekly three-hour laboratory experience working with preschool children is required at UNH Child-Family Center. Weekly three-hour seminar. Prereq: HEc 525. 4 cr.

**531. HOUSING AND DESIGN**
Housing examined in terms of design, physical, socio-psychological, and community needs. 4 cr.

**557. CONSUMER EDUCATION**
Role and responsibility of the consumer in the marketplace, including consumer decision making. Protective role of government as it relates to the consumer. 4 cr.

**573. HUMAN NUTRITION**
Principles of nutrition and application to life. 4 cr.

**575. NORMAL AND THERAPEUTIC NUTRITION**
Principles of nutrition and application to health during the life cycle; dietary treatment of some diseases. 4 cr.

**583. THE YOUNG ADULT**
Effects of experience on identity formation in normal development of adolescent to adulthood. 4 cr.

**607. PROFESSIONAL SEMINAR**
Philosophy, focus, and issues in home economics. Professional opportunities; role of home economist as an educator. 2 cr. Cr/F.

**615. SPECIALIZED CLOTHING CONSTRUCTION**
Process and techniques in pattern designing using the flat pattern method. Interrelated factors in fitting, design, and advanced clothing construction. Lab: application and experimentation. Prereq: HE 415 or permission. 4 cr.

**626. THE YOUNG CHILD**
Examines current research relating to infant and child development. Students are provided varied experiences such as participating in small group work, interacting with parents and/or young children, researching a topic of interest within the area of child development. Prereq: HEc 525. 4 cr.

**627. PRESCHOOL METHODS AND MATERIALS**
Learnings appropriate for young children; methods and materials for encouraging these learnings in a developmentally sound manner. Prereq: HEc 525; HEc 527; permission. 4 cr.

**657. MANAGEMENT AND DECISION MAKING IN THE FAMILY**
Management concepts, including decision making applied to families. 4 cr.

**671. INTRODUCTION TO FOOD SCIENCE**
Experimental study of food; application of principles underlying food preparation; experimentation in comparative food preparation. Prereq: HEc 418 or equivalent; organic chemistry. Lab fee $8. 4 cr.

**674. QUANTITY FOOD PURCHASING AND PRODUCTION**
Principles and methods; lab experiences in selective settings. Prereq: basic food preparation; permission. 4 cr.

**683. FAMILY RELATIONS**
Theories and supporting research; dynamics and patterns of interaction, role behavior, and development in families. Prereq: course in behavioral sciences. 4 cr.

**685. ONE SEMESTER AT THE MERRILL-PALMER INSTITUTE**
Junior or senior majors in HEc may attend the Merrill-Palmer Institute in Detroit, Michigan, for one year or one semester. Cr/F.

**695. INDEPENDENT STUDY**
Students with special ability in a selected area of home economics may work on a problem of special concern. Regular conferences with an adviser required. Prereq: department permission. May be repeated. 2 or 4 cr.

**696. FIELD EXPERIENCE**
Work with an agency, institution, or organization concerned with the welfare of families and individuals. Students will plan with department adviser and apply for approval. Students will live in or near the community in which they are working and will pay regular University tuition. Prereq: approval of faculty members and limited to HEc juniors and seniors. 8-16 cr.

**707. PRACTICUM IN HOME ECONOMICS**
Supervised in-depth experience with observation and participation to increase the student's understanding in a specific area of home economics. Choice of practicum from A) Child; B) Family; C) Consumer; D) Food and Nutrition. Prereq: HEc major; permission. 4 cr.

**709. BIOCHEMISTRY OF NUTRITION**
Intermediary metabolism of nutrients and energy; metabolism transport mechanisms; biological oxidations; interrelationships of carbohydrate, fat, and protein metabolism; obesity; control of hunger and appetite. Prereq: college course in biochemistry. (Also offered as AnSc 709.) 4 cr.

**715. CLOTHING IN RELATION TO HUMAN BEHAVIOR**
Research and theory in the social psychological aspects of clothing; clothing behavior of individuals and groups; stages of the life cycle, development of the self, and the phenomenon of fashion. 4 cr.

**725. PRESCHOOL PROGRAMS**
Organization of time, space, materials, and people to attain goals in early childhood programs. Prereq: HEc 627 or permission. 4 cr.

**727. STUDENT TEACHING IN THE PRESCHOOL-KINDERGARTEN**
Supervised teaching experience. Students spend 14 weeks, 18-20 hours per week, in a selected preschool working with a cooperating teacher. The student must apply at least one semester previous to the semester in which s(he) plans to student teach. Prereq: HEc major; HEc 525, 527, 626, 683, 725, and 793; Educ 500 and 706; PhEd 675; ThCo 520; Math 621 or 622; permission. Coreq: HEc 728. 6 cr.

**728. SEMINAR FOR STUDENT TEACHERS IN THE PRESCHOOL-KINDERGARTEN**
Students will enrich their student teaching experience with biweekly seminars throughout the semester as a supplement to their practical experience in the field. Prereq: HEc major; HEc 525, 527, 626, 627, 683, 725, and 793; Educ 500 and 706; PhEd 675; ThCo 520; Math 621 or 622. Coreq: HEc 727. 2 cr.

**754. PERSONAL AND FAMILY FINANCE**
Financial alternatives available to individuals and families during stages of the family life cycle. 4 cr.

**757. CONSUMER PROBLEMS**
Consumer problems analyzed from the perspective of family, business, and government interests. Prereq: 8 cr. in consumer studies; permission. 4 cr.

**758. CONSUMER PROTECTION**
Types of protection available to consumers; investigation and evaluation of the structure and operating procedures of regulatory agencies. Prereq: permission. 4 cr.

**774. CLINICAL DIETETICS**
Principles of normal nutrition applied to clinical problems; altered nutrient requirements in human disease. Diet therapy as applied to clinical nutrition. Prereq: HEc 573; HEc 506; a college course in biochemistry; permission. 4 cr.

**776. CONTEMPORARY ISSUES IN NUTRITION**
Focus on national and worldwide nutrition concerns. Approaches and materials used in nutrition education. Prereq: HEc 573 or 575; permission. 4 cr.

**786. DYNAMICS OF FAMILY CHANGE**
Theories and research for the assessment of family interaction patterns; planned intervention techniques. Students examine their interaction processes and their possible effect on intervention efforts. Prereq: HEc 683; Psyc 561. 4 cr.

**791. METHODS OF TEACHING HOME ECONOMICS**
Home economics in the school program; curriculum materials, methods, and resources in teaching. 4 cr.

**793. FAMILY LIFE EDUCATION**
Critical review of current issues and literature; materials and methods for programs such as sex education and parent education. Prereq: HEc 683; permission. 4 cr.

# Hotel Administration (Hotl)

**Program Director:** Melvin Sandler
**Associate Professors:** Richard Pew, emeritus; Melvin Sandler
**Assistant Professors:** David A. Ley, Eric B. Orkin, Neil R. Porta
**Lecturer:** Marcia Schurer
**Adjunct Professor:** Ronald A. Nykiel

**403. ELEMENTS OF INSTITUTIONAL ADMINISTRATION**
Food service and lodging industry. Application of classroom principles through lectures, field trips, food labs, catering for on-campus functions, and participation in gourmet dinner productions. 4 cr.

**550. INFORMATION PROCESSING IN HOSPITALITY MANAGEMENT**
A thorough survey of the fundamentals of business data processing is followed by an investigation of the specific applications of the technology to the field of hospitality management. Students conduct feasibility studies for area businesses. No programming is taught or required. 4 cr.

**556. MANAGEMENT OF PHYSICAL STRUCTURES**
Components of physical structures as functional units. Lectures, guest speakers, and specialists related to design and construction. Students develop simulated hotel/motel construction projects. 4 cr.

**618. FINANCIAL ANALYSIS AND CONTROL**
Managerial accounting concepts and techniques applicable to hospitality and service industries. Prereq: Admn 502. 4 cr.

**655. MANAGEMENT FOR TRANSIENT, LEISURE, AND INSTITUTIONAL SERVICES**
Lodging management trends and current industry issues; organization of hospitality services; management roles and functions; executive and employee selection and development. Students compare and contrast work roles of management in a large hotel. 4 cr.

**667. FUNCTIONAL MANAGEMENT**
Integration of management principles and techniques. Presentation of large-scale gourmet dinners; service as consultants to on-campus food service facilities; individual research projects. Prereq: Hotl 403. 4 cr.

**670. OPERATIONAL ANALYSIS IN THE HOSPITALITY INDUSTRY**
Management policy decisions in the hospitality services industry, developed around "live" hospitality case situations. Students required to use their knowledge of organizational behavior, marketing, and accounting. Written analyses and oral presentations made on individual or group basis. Senior standing. 4 cr.

**695. INDEPENDENT ANALYSIS**
Study and research project for honor students to advance knowledge in lodging and food services fields. Prereq: senior standing and permission. 2-4 cr.

**698. TOPICS IN HOTEL ADMINISTRATION**
Special topics and developments in lodging and food services industries. Prereq: senior standing and permission. 4 cr.

**700. MARKETS AND PROMOTION OF PUBLIC SERVICES**
Principles of marketing and management applied to lodging and food service industry. Major consulting projects for industry clients, including a formal report and presentation to the class and to the clients. Prereq: Admn 651. 4 cr.

**795. INTERNSHIP**
Fieldwork in an organization for on-to-job skill development. Normally supervision is provided by a qualified individual in the organization, with frequent consultation by a faculty sponsor. A written report is required of the student. Internships may be part-time or full-time, with course credits assigned accordingly. 1-16 cr.

**798. SEMINAR**
Special topics in hotel administration covering material not normally covered in the regular curriculum. Prereq: permission. 1-4 cr.

# Humanities (Huma)

**401. INTRODUCTION TO THE HUMANITIES**
Interdisciplinary study of creative arts and living ideas. Primarily for freshmen with little or no previous exposure to humanities. Multisection course on different topics. Three sections must be passed to receive credit. Sections divided into three categories: 1) practical aspects of the creative process; 2) ideas that have influenced people from ancient to modern times; 3) area studies. Cultural events included when appropriate. May be repeated for credit if different sections are taken. 4 cr.

**501. HUMANITIES: THE ANCIENT WORLD**
Appreciation of literature, the arts, and philosophy. Roots of Western civilization: Homer, Greek tradegy, Plato, Aristotle, the Bible, Vergil. Weekly lecture series, slides, films, visit to Boston museums. 4 cr.

**502. HUMANITIES: THE MODERN WORLD**
Literature, philosophy, and art from Dante through the French and Russian realists. Dante, Castiglione, Machiavelli, Montaigne, Racine, Molière, Pope, Goethe, Wordsworth, Zola, Tolstoy. Weekly lecture series, slides, films, visit to Boston museums. 4 cr.

**503. HUMANITIES: THE 20th CENTURY**
Literature, philosophies, and art of Western civilization in the last hundred years. Prereq: Huma 502, or course in history of literature, philosophy, or the arts. 4 cr.

**595. SPECIAL STUDIES IN THE HUMANITIES**
Selected topics not covered by existing courses, with subjects to vary. May be repeated for credit. 2 or 4 cr.

**699. SENIOR PROJECT IN HUMANITIES**
Independent study open only to senior humanities majors with individual project approved and supervised by faculty. 2-6 cr.

# Hydrology

**(See Institute of Natural and Environmental Resources)**

# Institute of Natural and Environmental Resources

**Director:** David P. Olson

**Professors:** James R. Bowring, emeritus; Richard A. Andrews, James P. Barrett, Paul E. Bruns, Gordon L. Byers, William H. Drew, Owen B. Durgin, Nicolas Engalichev, Bennett B. Foster, Francis R. Hall, William F. Henry, John L. Hill, Harold W. Hocker, Jr., David P. Olson, Allan B. Prince
**Associate Professors:** John E. Carroll, S. Lawrence Dingman, Robert D. Harter, Edmund F. Jansen, William W. Mautz, Nobel K. Peterson, R. Marcel Reeves, Oliver P. Wallace, Silas B. Weeks, Richard R. Weyrick
**Assistant Professors:** Robert T. Eckert, Peter H. Greenwood, Bruce E. Lindsay, Albert E. Luloff, Donald R. Miller, Roger P. Sloan
**Adjunct Professors:** George E. Frick, Nelson L. LeRay
**Adjunct Associate Professors:** C. Anthony Federer, William B. Leak, Robert S. Pierce
**Adjunct Assistant Professors:** Peter W. Garrett
**Instructor:** Kurt N. Olson

## Natural and Environmental Resources (INER)

**401. NATURAL AND HUMAN RESOURCES OF NEW ENGLAND**
Historical and present population and settlement patterns; potential demographic patterns; changing socioeconomic, political, and cultural patterns; transportation characteristics; changing resource foundation; soils, minerals, water, air, forests, wildlife, fisheries, parks, critical natural environments, and aesthetic amenities. Outside speakers. Mr. Carroll. 2 cr.

**511. COMPUTATION METHODS IN NATURAL RESOURCES**
Computer programming using BASIC on remote terminals to solve forestry and other natural resource problems. No credit if Math 403 is taken. Staff. Lab. 2 cr.

**528. APPLIED STATISTICS I**
Development of elementary statistical techniques through the analysis of prepared data. Continuous and discrete probability distributions; distributions of sample statistics; small-sample theory; regression; correlation; nonparametrics. Permission of instructor required for upper division students. Mr. Durgin. 4 cr.

**581. METHODS IN LAND SURVEYING**
Principles and field methods of land surveying for the natural resource manager; measurement of distance, direction, and elevation; instrumentation and computation; legal aspects of land description and boundary. Prereq: FoRs 542 or permission. Mr. Jenkins. Lab. 4 cr.

**595, 596. PROBLEMS IN NATURAL AND ENVIRONMENTAL RESOURCES**
Students pursue field, laboratory, or library problems in natural and environmental resources that are not covered by other courses. A faculty consultant and a study topic must be chosen prior to registration for the course. In consultation with the faculty adviser, students are expected to select the problem area, create a bibliography for reflection, and find channels to actively pursue the topic. A professionally written paper is expected at termination of the study. May be repeated once for credit. Prereq: permission. 2-4 cr.

**603, 605. ENVIRONMENTS OF NEW HAMPSHIRE**
Societal and ecological modifications of New Hampshire environments from seacoast to alpine tundra, including the physical, biological, economic, and societal modifications of each system. Prereq: basic course in biology and economics or permission. 3 cr. (Summer Session only.)

**604, 606. ENVIRONMENTS OF NEW HAMPSHIRE LAB**
Techniques in collection and maintenance of plant, animal, and geologic specimens; demonstrations on the ecologic and environmental systems; use of audiovisual aids to learn the systems; and field observation and collection. Transportation fee. 2 cr.

**609, 610. SEMINAR**
Seminars arranged according to student needs: A) Community Development; B) Forestry; C) Hydrology; D) Resource Economics; E) Soils; F) Wildlife; G) Fire Ecology; H) Environmental Conservation; I) Coastal Zone Management. Staff. 1-2 cr.

**611. COASTAL RESOURCE MANAGEMENT**
Systematic and regional analysis of the environmental problems caused by human use and misuse of the coastal zone (estuaries, wetlands, saltmarsh, beaches); alteration, destruction, and pollution of these environments. Some emphasis on coast and shoreline of the Northeast with fieldwork. Transportation fee. Staff. 4 cr.

**615. LINEAR PROGRAMMING METHODS**
Setting up and solving problems by the simplex and distribution methods; variation in linear programming methods with applications; nonlinear programming, discrete programming; and solving input-output and game-theory problems. Applications to firm and aggregate economic analysis. Prereq: Elementary Matrix Algebra or permission. Mr. Andrews. 4 cr. (Offered every third semester.)

**635. CONTEMPORARY CONSERVATION ISSUES**
How man's technology causes biological and social conflicts when applied to wild-land resources; multiple demands of game, timber, water, minerals, and soil ecosystems vs. economic growth. Elective for all students except freshmen. Mr. Wallace, Mr. K. Olson. 4 cr.

**637. PRACTICUM IN ENVIRONMENTAL CONSERVATION**
Independent participation in an environmental conservation activity to help people understand and improve environmental quality. Students plan, present, and discuss their activities. Individual or group projects may be developed with any faculty member within or outside INER. Research projects not acceptable. Prereq: senior standing. Staff. Lab. 4 cr. Cr/F.

**701. STATISTICAL METHODS I**
Analysis of variance and general linear models; measured numbers, nature of statistical evidence, sampling distributions, and principles of statistical inference; application of specific linear models to given sets of data. Prereq: upper-division undergraduate or graduate standing. Mr. Durgin. 4 cr. (Not offered every semester.)

**702. NATURAL RESOURCES POLICY**
Contemporary issues in the management and allocation of natural resources; impact of humans on agricultural and forest lands, water, wildlife, fisheries, and minerals; historical perspective of current resource policies. Prereq: permission. Mr. Carroll. 4 cr.

**709. SOILS AND COMMUNITY PLANNING**
Using a town plan and soils map, students develop reports for multiple urban and rural land-use-housing, sewage, recreation, transportation, runoff, etc. USDA soil classification system; Soil Conversation Service rating criteria; New Hampshire soils. Guest lecturers. Prereq: permission. Mr. Peterson. 2 cr.

**711. STATISTICAL METHODS II**
Intermediate course in statistics; basic concepts of sampling, linear models and analyses for one-way and multiway classification, factorial arrangement of treatments, multiple regression, and covariance. Computer programs used in analyzing data. Examples from environmental sciences. Prereq: INER 528 or equivalent. Mr. Barrett. 4 cr.

**712. SAMPLING TECHNIQUES**
Techniques of sampling finite populations in environmental sciences; choice of sampling unit and frame, estimation of sample size, confidence limits, and comparisons of sample designs. Prereq: INER 528 or equivalent. Mr. Barrett. 2-4 cr.

**713. QUANTITATIVE ECOLOGY**
Applied quantitative techniques: basic concepts in probability and statistics applied to ecological systems; population dynamics; spatial patterns; species abundance and diversity; classification and ordination; production; and energy and nutrient flow. Additional credit for in-depth mathematical analysis of a particular topic. Prereq: introductory courses in calculus, statistics, and ecology. Mr. Barrett. 3 or 4 cr.

**718. LAW OF NATURAL RESOURCES AND ENVIRONMENT**
For resource managers: the legal system pertaining to resource management, protection of the environment, and possibilities for future action. Prereq: INER 635 or REco 606 or permission. Mr. Tucker. 3 cr.

**757. BASICS OF REMOTE SENSING**
Fundamentals for application of photographic and nonphotographic sensors to information gathering in natural resource fields; emphasis is on the interpretation of aerial photographs. Applications to forestry, wildlife, land-use planning, earth sciences, soils, hydrology, and engineering. Transportation fee. Mr. Bruns, Mr. K. Olson. Lab. 2 cr.

**758. APPLICATIONS OF REMOTE SENSING**
Applications of remote sensing to the student's disciplinary interest. Student projects developed using available conventional aerial photography or other imagery. Prereq: INER 757 or equivalent. Transportation fee. Mr. K. Olson. Lab. 2 cr.

**795, 796. INVESTIGATIONS**
Investigations in 1) Resource Administration; 2) Resource Management; 3) Resource Policy; 4) Public Laws and Resources. May be repeated. Prereq: permission. Staff. 2-4 cr.

**797. FOREST RECREATION SEMINAR**
Recreational use of nonurban lands; economics of public and private developments; planning for state and private recreational use, social aspects. Class project. Prereq: junior standing; permission. Staff. 4 cr.

## Forest Resources (FoRs)

**423. DENDROLOGY**
North American forest trees: taxonomy, silvical characteristics, community relationships; major forest regions. Restricted to forest resources and wildlife management majors; others by permission of instructor. Must be taken concurrently with FoRs 425. Mr. Eckert. 2 cr.

**425. FIELD IDENTIFICATION OF TREES AND SHRUBS**
Identification and nomenclature of important North American trees; emphasis on trees and associated woody species of the Northeast. Forest resources and wildlife management majors must take concurrently with FoRs 423. Transportation fee. Mr. Eckert. Lab. 2 cr.

**426. WOOD SCIENCE AND TECHNOLOGY**
Microstructure; physical, chemical, and mechanical properties; identification of commercially important timbers; seasoning and preservation of wood; log and lumber grading; sawmill volume and grade yield study. Transportation fee. Mr. Hill. Lab. 4 cr.

**500. SUMMER WORK EXPERIENCE**
Work in forestry or closely related field; must be performed under professional supervision or approved by forest resources faculty. Students are responsible for arranging their own experience. (Forest resources majors only.) Staff. May be repeated. 0 cr. Cr/F.

**527. SILVICS**
Ecological base of silviculture; classification of forest communities; environmental factors and their influence on forest vegetation; influence of vegetation on environment. Transportation fee. Prereq: Bot 411; FoRs 425 or Bot 566; Soil 501 taken concurrently. Mr. Hocker. Lab. 4 cr.

**542. FORESTLAND MEASUREMENT AND MAPPING**
Elementary measuring equipment and techniques; preparation of maps; public land survey; courthouse deed search. Two-week field session following spring semester. Transportation fee. (Forest resources and wildlife majors only.) Mr. Foster, Mr. Weyrick. 2 cr.

**544. FOREST ECONOMICS**
Supply and demand for forest products and services; forestry and the general economy; economics of the firm; forest evaluation; taxation. Prereq: a course in principles of economics. Mr. Weyrick. 4 cr.

**629. SILVICULTURE**
Application of ecological knowledge to the control, establishment, composition, and growth of forest stands for economic purposes. Transportation fee. Prereq: FoRs 423 and 527. Mr. Hocker. Lab. 3 cr.

**630. FOREST HARVESTING, SILVICULTURE, AND MANAGEMENT**
Section 1: harvesting and silviculture activities. Prereq: FoRs 629 or permission. Section 2: extended field trip to another forest region. Prereq: senior standing; FoRs 745; /or permission. Staff. Limited enrollment. 1-2 cr. Cr/F.

**634. WILDLIFE ECOLOGY**
Principles and factors affecting wildlife populations, including wildlife management, population dynamics, identification, census methods, habitat requirements. Research project required. Prereq: basic course in biology, botany, or zoology; /or permission. Transportation fee. Mr. Mautz, Mr. Miller. Lab. 4 cr.

**644. FOREST MENSURATION**
Basic sampling techniques used in natural resource inventories including field applications. Estimates of forest growth and yield. Prereq: calculus, statistics, computer programming, and elementary land surveying. Mr. Barrett. Lab. 4 cr.

**652. FOREST RESOURCES MEASUREMENTS AND MAPPING**
Aerial photo type mapping and forest resources inventory: type identification and delineation, map construction, cruise design, and forest resources inventory. Two-week field session following spring semester. Transportation fee. (Forest resources majors, others by permission.) Prereq: FoRs 527 and 644. Mr. K. Olson, Mr. Barrett. 2 cr.

**660. FOREST FIRE PROTECTION**
Forest fire prevention, behavior, and effective control; weather phenomena; other aspects of forest damage; fire effects and use. Prereq: FoRs 527 or 629; Soil 501. Transportation fee. Mr. Weyrick. Lab. 2 cr.

**672. ECOLOGICAL ENERGETICS**
Flow of energy through ecological systems; thermodynamics in biological systems; photosynthesis; respiration, trophic structure; productivity; ecological efficiency; human use of energy, present and future, and the effects on energy flow in the ecosystem. Prereq: an ecology course or permission. Mr. Mautz. 4 cr.

**695, 696. INVESTIGATIONS IN FORESTRY**
A) Forest Ecology; B) Photogrammetry; C) Wood Products; D) Game Management; E) Mensuration; F) Forest Economics; G) Forest Management; H) Operations Control and Analysis; I) Recreation; J) Policy; K) Wildlife Physiology. Prereq: permission. Staff. 1-4 cr.

**720. FOREST GENETICS**
Genetics of forest tree improvement; variation in natural populations, breeding methods, physiological characters, quantitative data analysis; Prereq: PlSc 604 (Zool 604); FoRs 629; Statistics; /or permission. Transportation fee. Mr. Eckert. Lab. 3 cr. (Not offered every year.)

**722. ADVANCED SILVICULTURE**
Intensive silviculture of forest stands. Artificial regeneration (e.g., alternative regeneration methods and site preparation); plantation management (e.g., thinning schedules and fertilization). Prereq: FoRs 629 or equivalent; permission. Transportation fee. Mr. Eckert and Mr. Hocker. 4 cr. (Offered 1979-80.)

**734. FOREST PROTECTION SEMINAR**
Discussion and special problems based on principles and techniques of forest protection. Prereq: permission. Mr. Weyrick. 3 cr.

**737. GAME MANAGEMENT I**
Biological characteristics, habitat requirements, research and management practices of upland game birds and big game animals. Several all-day field trips required (possibly on weekends) to New England wildlife areas. Transportation fee. Prereq: wildlife management major or permission. Mr. Mautz. Lab. 4 cr.

**738. GAME MANAGEMENT II**
Biological characteristics, habitat requirements, research and management practices of small game animals, furbearers, predators, and waterfowl. Several all-day field trips required (possibly on weekends) to New England wildlife areas. Transportation fee. Prereq: wildlife management major or permission. Mr. Miller. Lab. 4 cr.

**745. FOREST MANAGEMENT**
Forest land ownership; management objectives; forest inventory regulation and economic analysis; forest administration; professional responsibilities and opportunities. Prereq: completion of junior year in forestry curriculum. Transportation fee. Mr. Weyrick, Mr. Bruns. Lab. 4 cr.

**753. OPERATIONS CONTROL AND ANALYSIS**
Quantitative tools for decision making in forest resource management activities; development and analysis of cost functions, timber and stumpage valuation, forecasting, linear programming. Monte Carlo simulation, PERT, Prereq: calculus; forest economics; statistics; mensuration. Mr. Foster. Lab. 4 cr.

**754. WOOD PRODUCTS MANUFACTURE AND MARKETING**
Wood products from harvesting and procurement of raw material to finished product processes; management decisions, marketing, and promotion problems. Visits to harvesting operations and manufacturing plants in New England. Transportation fee. Prereq: FoRs 426 or permission. Mr. Hill. Lab. 4 cr.

**764. FOREST INDUSTRY ECONOMICS**
Business methods and economics in the forest industry; planning for minimum cost operations and profitable use of capital in a forest enterprise. Individual projects. Prereq: senior standing; permission. Mr. Wallace. 4 cr. (Not offered every year.)

**798. FOREST RESOURCES MANAGEMENT SEMINAR**
Population trends and human needs in relation to forest land productivity for timber, wildlife, water, recreation, and grazing. Class organized for group planning to maximize forest productivity for the state of New Hampshire. Prereq: FoRs 745. Mr. Wallace. Lab. 4 cr.

## Hydrology (Hydr)

**504. FRESHWATER RESOURCES**
Major determinants of freshwater resources including: hydrologic cycle and water balance; precipitation; stream-flow measurement; pollution; water supply and sewage treatment; water resource development. Mr. Byers. Lab. 4 cr.

**603. HYDROLOGY AND WATER MANAGEMENT**
Engineering principles and the control of water; precipitation and stream-flow measurement, hydrograph development, estimating runoff from a watershed, and the design of structures to control this runoff. Instrumentation and problem analysis. Transportation fee. Mr. Byers. Lab. 4 cr.

**705. PRINCIPLES OF HYDROLOGY**
Physical principles important in the hydrologic cycle, including: basic equations, properties of water, movement of water in natural environments, formation of precipitation, relations between precipitation and streamflow, snow-melt, evapotranspiration, interception, infiltration, relations between groundwater and stream-flow, and hydrologic aspects of water quality. Problems of measurement and aspects of statistical treatment of hydrologic data. Transportation fee. Prereq: calculus. Mr. Dingman. Lab. 4 cr.

**710. GROUNDWATER HYDROLOGY**
Principles governing occurrence, location, and development of groundwater; well hydraulics, geophysical exploration, and chemical quality of water; use of fluid and electrical models; and selected problems. Basic course for hydrology majors and other qualified students. Prereq: one year of calculus. Mr. Hall. Lab. 4 cr.

**795, 796. INDEPENDENT WORK IN HYDROLOGY**
A) Hydrology; B) Chemistry of Water; C) Water Resource Management. Student may choose topic and faculty consultant. Staff. 1-4 cr.

## Resource Economics (REco)

**411. INTRODUCTION TO RESOURCE ECONOMICS**
Organization and operation of the American economic system; role that resource use plays within that system. Essential elements of microeconomic principles; institutions and programs affecting resource use and the impact on environmental quality. Principles dealing with the economic operation of individual consumption and production units within the framework of supply, demand, price, and the economic principles of marginality. Major fields of resource economics are reviewed. Staff. Cannot be taken for credit after Econ 402 or equivalent. 4 cr.

**501. AGRICULTURAL AND NATURAL RESOURCE PRODUCT MARKETING**
Structure, organization, and performance of the business section in agriculture, forestry, and other local natural resource-based industries; commodity marketing systems; demand estimation, pricing policies, consumer characteristics, and related topics. Prereq: REco 411 or equivalent; /or permission. Mr. Andrews. 4 cr. (Offered every third semester.)

**504. MANAGEMENT OF FARM AND RELATED RESOURCE-BASED BUSINESS**
Planning, operation, and control of the farm with emphasis on application for the commercial farmer. Prereq: REco 411 or equivalent; /or permission. Staff. Lab. 4 cr. (Not offered every year.)

**506. POPULATION, FOOD, AND RESOURCE USE IN DEVELOPING COUNTRIES**
Economic, technical, cultural, social, and political factors that influence food supplies, nutrition resource use, employment, and income distribution in the developing countries; the population explosion; strategies for expanding food supplies; social and institutional constraints, strategies and policies for economic development. Prereq: REco 411, or equivalent. Mr. Jansen. 4 cr. (Offered every third semester.)

**606. LAND ECONOMICS AND USE**
Economic and institutional factors affecting human use of land resources; historical discussion of land ownership patterns; supply and demand; production relationships; location and resource use; benefit-cost analysis; institutional restraints and planning for more efficient use of land. The real estate market and taxation. Prereq: REco 411, or equivalent. Mr. Henry. 4 cr. (Offered every third semester.)

**611. MARINE RESOURCE ECONOMICS**
Economic overview of the marine environment; interactions and conflicts surrounding this multiple-use resource. Economics of fisheries; marine recreation; offshore facilities; aquaculture; waste disposal. Prereq: REco 411 or Econ 402; /or permission. Mr. Greenwood. 4 cr. (Offered every third semester.)

**676. ECONOMICS OF WATER USE AND QUALITY MANAGEMENT**
Economics of water use; role of government and policy agencies, water supply and demand, economic impact of water and water quality standards, alternatives in quality management, externalities, and methods of evaluation. Prereq: elementary biological or physical science (or Hydr 504); elementary economics. Mr. Andrews. 4 cr. (Offered every third semester.)

**706. ECONOMICS OF RESOURCE DEVELOPMENT**
Resource scarcity and theories of economic development; major resource development problems of land and natural resources, urban-rural conflicting demands, and conservation and water supply; capital needs, externalities, and market failure. Prereq: intermediate economic theory. Mr. Jansen. 4 cr. (Offered every third semester.)

**710. RESOURCE ECONOMICS SEMINAR**
Seminars arranged to students' needs and offered as demand warrants: A) Agricultural Economics and Food Policy; B) Rural Development; C) Marine Economics; D) Location of Economic Activity; E) Land and Water Economics; F) Quantitative Methods; G) Environmental Economics. In-depth treatment of area, including classic works. May be repeated. Staff. 2-4 cr.

**756. REGIONAL ECONOMIC ANALYSIS**
Concepts and methods of delineating regional economies, methods of measuring activity, regional development, and public policies. Emphasis on empirical research studies. Prereq: intermediate economic theory; elementary statistics; calculus; linear programming; /or permission. Mr. Lindsay. 4 cr. (Offered every third semester.)

**795-796. INVESTIGATIONS IN RESOURCE ECONOMICS**
Special assignments in readings, investigations, or field problems. May be repeated. A) Agricultural Marketing; B) Agricultural Production and Farm Management; C) Community Development; D) Economics of Human Resources; E) Economics of Population and Food; F) Land Economics; G) Marine Economics; H) Rural Economic Development; I) Regional Economics; J) Water Economics. Prereq: permission. Staff. 2-4 cr.

## Community Development

**507. INTRODUCTION TO COMMUNITY AND COMMUNITY DEVELOPMENT**
Principal theories and methods of community and community development; skills required to help people enhance the social and economic well-being of their communities. Institutional structures; change processes; citizen participation in decision-making; and problem analysis in contemporary, nonmetropolitan communities in New England. Mr. Luloff. Lab. 4 cr.

**508. APPLIED COMMUNITY DEVELOPMENT**
Students work in an actual community, assisting individuals and groups to identify needs and problems, establish attainable and objective goals, assess requirements and resources, and formulate programs for development; methods of collection, analysis, and integration of pertinent primary and secondary economic, social, political, and physical data for community development. Prereq: REco 507 or permission. Staff. Lab. 4 cr.

**614. COMMUNITY PLANNING**
Community planning process in nonmetropolitan communities; practical application of planning techniques. Community components: housing, jobs, schools, recreation, transportation; community appearance and the administrative structure for planning. Use of planning tools: data gathering and analysis, the master plan, zoning and subdivision regulations, community development programs. Prereq: REco 411; REco 507; /or permission. Staff. 4 cr. (Not offered every year.)

**705. PLANNED CHANGE IN NONMETROPOLITAN COMMUNITIES**
Discussion and application of community development theory and principles using appropriate research methodologies. Areas of study chosen from: population growth, community planning and development, provision and distribution of services, rural-urban difference, and systems management. Emphasis on empirical research studies. Students may participate in community-development activities. May include placement in field agency. Prereq: REco 508; INCO 650 or INER 701 or equivalent; permission. (Offered in even years only.) Mr. Luloff. 4 cr.

**717. LAW OF COMMUNITY PLANNING**
Common law and the Constitution with respect to property law, including eminent domain, land-use planning, urban renewal, and zoning. Makes the nonlawyer aware of the influence and operation of the legal system in community development. Mr. Tucker. 4 cr.

## Soil Science (Soil)

**501. SOILS AND THE ENVIRONMENT**
Physical, chemical, and biological aspects of soils in the environment. Labs coordinate with lectures. Transportation fee. Mr. Peterson. Lab. 4 cr.

**502. SOIL-PLANT RELATIONSHIPS**
Soils and the requirements for optimum growth of plants, with emphasis on nutrient availability; soil needs for meeting world food problems. Transportation fee. Mr. Peterson. Lab. 4 cr.

**602. CHEMICAL ANALYSIS OF SOIL**
Methods of soil chemical analysis. Prereq: quantitative analysis; permission. Mr. Harter. Lab. 2 cr.

**605. MINERAL CYCLING IN TERRESTRIAL ECOSYSTEMS**
How minerals, primarily plant nutrients, are cycled in soils and plants; chemical, microbiological, and physical interactions in the soil; nutrient uptake; how these nutrients are replaced in undisturbed ecosystems; how the cycles are disrupted by human activities; New Hampshire's dominant soil-plant communities; greenhouse experience and field trips. Prereq: Soil 501; Bot 411 or PlSc 421; /or permission. Mr. Harter. Transportation fee. Lab. 4 cr.

**614. SOIL MANAGEMENT**
Study and application of the principles of soil tillage, soil moisture control, soil fertility maintenance, and soil conservation practices to the successful management of the soil for crop production. Prereq: Soil 501. Mr. Breeding. Lab. 3 cr.

**701. PHYSICS OF SOILS**
Soil as a physical system; textural and structural analysis of soils, water flow and retention, and heat and gas transfer; physical properties of soil and plant growth; methods of soil physical analysis. Prereq: Soil 501 or permission. Staff. Lab. 4 cr.

**702. CHEMISTRY OF SOILS**
Chemical composition of soil; colloidal phenomena and the exchange and fixation of elements, cation exchange capacity and source of negative charge; inorganic reactions in soil and their effect on soil properties. Prereq: one year of college chemistry or permission. Mr. Harter. 3 cr.

**704. SOIL CLASSIFICATION AND MAPPING**
Soil genesis, morphology, classification, and mapping; major classification systems used in the U.S. and throughout the world as they relate to human uses of the soil. Prereq: Soil 501; an introductory geology course; /or permission. Transportation fee. Mr. Peterson. 4 cr.

**795, 796. INDEPENDENT WORK IN SOIL SCIENCE**
A) Soil-Plant Relationships; B) Physics of Soils; C) Chemistry of Soils; D) Soil Classification. Majors must take 795 and 796 for two credits per semester in their senior year. Student may choose faculty consultant and topics. Interested students from other departments may enroll for two credits per course.

# Inter-College Courses (Inco)

**598, 599. INDEPENDENT WORK-STUDY**
(598 off-campus, 599 on-campus). These courses enable students to pursue a semester of independent study in disciplines not within the purview of a particular department. Students select the area in which they wish to work, create their own bibliography for reflection, and find their own channels to pursue the problem actively. Students must write a proposal identifying the manner in which they intend to pursue the study, and obtain the sponsorship of a faculty member. The proposal, with the faculty sponsor's endorsement, should be submitted to the Teaching-Learning Committee of the appropriate college, via the college dean's office. Once approval of the college Teaching-Learning Committee is obtained, students must have the signature of the Teaching-Learning Council chairperson for registration purposes. For information, please contact Dr. Lydia Crowson, 201 Thompson Hall, or Dr. John G. Chaltas, Room 307A, Dimond Library, chairperson of the Teaching-Learning Council.

**650. INTRODUCTORY APPLIED STATISTICS**
A selectable set of 1-credit modules; the number of modules offered, usually about 10, will vary from term to term; consult the Office of Academic Computing for semester offerings. Students should consult with faculty of their major department in order to choose those modules appropriate to their field of study. Module 650 or equivalent is a prerequisite for all other modules except 650D. (May be repeated for credit.) Permission required to register for more than 5 credits per term. 1-12 cr.

**650. Introductory Statistics**
Estimates, confidence intervals, and tests of hypotheses.

**650A. Correlation and Regression I**
Use of computer programs for typical correlation and regression analyses.

**650B. Correlation and Regression II**
Emphasis on Regression I procedures and pure error as well as use of dummy variable coding techniques. Prereq: 650A or permission.

**650C. Sampling I**
Basic sampling concepts and common sampling procedures.

**650D. Probability I**
Introductory applications to discrete sample spaces.

**650E. Chi Square**
Tests of accordance between observed and hypothesized (goodness of fit) for ordinal-level data.

**650F. Planning an Investigation I**
Controlled experiments using basic experimental designs with a single treatment factor: analysis of variance.

**650G. Planning an Investigation II**
Treatment selection and methods of summarizing results obtained using factorial tretament sets. Prereq: 650F or permission.

**650H. Description and Interpretation of Data I**
Origins and need for characterizing variability.

**650I. Description and Interpretation of Data II**
Sampling distributions and confidence intervals.

## Italian

(See Ancient and Modern Languages and Literatures)

## Japanese

(See Ancient and Modern Languages and Literatures)

## Latin

(See Ancient and Modern Languages and Literatures)

## Linguistics (Ling)

**505. INTRODUCTION TO LINGUISTICS**
Language as one of the most important human phenomena. Use and misuse of language for social communication and for the verbal arts. Dialects, slang, language change, language acquisition, language and thought. Introduction to scientific methodology of linguistics and modern grammar (phonology, syntax, semantics). Relationships of language to the humanities, psychology, and sociology. (Also offered as Engl 505.) 4 cr. .

**506. INTRODUCTION TO COMPARATIVE AND HISTORICAL LINGUISTICS**
Major language families (primarily Indo-European) and the relationships among languages within a family. Diachronic studies; methods of writing; linguistic change; glottochronology; etymological studies. Some language training and Ling 505 desirable. (Also offered as Clas 506.) 4 cr.

**795, 796. INDEPENDENT STUDY**
A) Synchronic Linguistics; B) Diachronic Linguistics; C) Linguistic Theory. For students showing a special aptitude for linguistics who desire to pursue a line of inquiry for which no appropriate course is offered. All requests must be forwarded by the faculty sponsor to the director of the Interdepartmental Linguistics Committee. 1-4 cr.

# Mathematics and Computer Science

**Chairperson:** M. Evans Munroe

**Professors:** Richard E. Johnson, emeritus; William L. Kichline, emeritus; Richard H. Balomenos, Edwartd H. Batho, Homer F. Bechtell, Jr., David M. Burton, Arthur H. Copeland, Jr., A. Robb Jacoby, Shan S. Kuo, M. Evans Munroe, Eric A. Nordgren, James Radlow, Shepley L. Ross, Robert J. Silverman
**Associate Professors:** Albert B. Bennett, Jr., William E. Bonnice, William E. Geeslin, Robert O. Kimball, Loren D. Meeker, Berrien Moore III, Albert O. Shar, Samuel D. Shore, Donovan H. Van Osdol
**Assistant Professors:** R. Daniel Bergeron, Eugene C. Freuder, Marie A. Gaudard, Donald Hadwin, Robert D. Russell

## Mathematics (Math)

**401. ELEMENTARY MATH I**
Fractions, exponents, and radicals; factoring; linear equations; areas and volume of geometric figures. Not for credit by students with one or more years of college preparatory mathematics. 0 or 4 cr.

**402. ELEMENTARY MATH II**
Basic algebra covering absolute value, inequalities, quadratic equations, two-dimensional coordinate system, distance, slope, curve sketching, systems of equations, polynomials of higher order. Prereq: Math 401 or equivalent. Not for credit by students with two or more years of college preparatory mathematics. 0 or 4 cr.

**405. ELEMENTARY FUNCTIONS**
Understanding of mathematical concepts as a preparation for calculus. Exponential, logarithmic, and trigonometric functions; trigonometric identities and equations; inverse functions; rational functions; graphs. Prereq: Math 402 or two years of high school mathematics. Not for credit by students with 3 or more years of college preparatory mathematics. 0 or 4 cr.

**419. EVOLUTION OF MATHEMATICS**
Mathematics from antiquity to the present; origins of the various methods and branches. How and why mathematical concepts, such as number and geometry, evolved. Prereq: three college preparatory mathematics units. Credit toward a math major only in mathematics education. 4 cr.

**420. FUNDAMENTAL MATHEMATICS**
Topics selected from: logic, set theory, probability, statistics, linear algebra, linear programming, game theory, and graph theory. Not a preparation for calculus. Prereq: three college preparatory math units. No credit toward a math major. 4 cr.

**425. CALCULUS I**
Analytic geometry and calculus. Instruction at various paces and a special testing program for students to proceed at own pace. Prereq: at least three college preparatory math units including trigonometry. 4 cr.

**426. CALCULUS II**
Calculus of functions of one argument. Instruction at various paces and a special testing program for students to proceed at own pace. Prereq: Math 425. 4 cr.

**527. DIFFERENTIAL EQUATIONS WITH LINEAR ALGEBRA**
Linear differential equations, matrix algebra, linear transformation and change of basis, eigenvalues, linear systems, series solution of differential equations. Prereq: Math 426. 4 cr.

**528. MULTIDIMENSIONAL CALCULUS**
Partial differentiation; composite functions and chain rules; maxima and minima; transformations; vector algebra; vector functions; gradient, divergence, and curl; curves and surfaces; multiple, line, and surface integrals; integral theorems. Prereq: Math 527. 4 cr.

**531. INTRODUCTION TO ABSTRACT MATHEMATICS**
Logic and set theory with applications to the development of the real number system. Prereq: Math 426. 4 cr.

**621. NUMBER SYSTEMS FOR ELEMENTARY SCHOOL TEACHERS**
Counting and set concepts, whole numbers, fractions, negative numbers, real numbers, numeration systems, inductive and deductive reasoning. Mathematical laboratory approach. Prereq: permission. Major credit only for elementary mathematics education majors. 4 cr.

**622. GEOMETRY FOR ELEMENTARY SCHOOL TEACHERS**
Deductive systems, metric geometry, congruence, symmetry, parallelism, similarity, transformation, measurement, polygons and circles, polyhedra. Mathematical laboratory approach. Prereq: Math 621. Major credit only for elementary mathematics education majors. 4 cr.

**623. TOPICS FOR ELEMENTARY SCHOOL TEACHERS**
Modulo arithmetic, logic and flow charting, coordinate systems, graphing linear equations and applications, quadratic equations and applications, combinations, permutation, probability, statistics. Mathematical laboratory approach. Prereq: Math 621. Major credit only for elementary mathematics education majors. 4 cr.

**636. PROBABILITY AND STATISTICS**
Sample spaces (discrete only), events, combinations, conditional probability, independence, distributions, expectation, statistical description, random variables, sampling, estimation, tests, and applications. Credit toward a mathematics major only in mathematics education and option programs. 4 cr.

**644. APPLIED PROBABILITY AND STATISTICS**
Introductory course for students in engineering, the physical sciences, interdisciplinary mathematics programs, and computer science. Prereq: Math 425-426. Not for credit if credit received for Math 636. 4 cr.

**645. APPLIED LINEAR ALGEBRA**
Applied matrix theory; eigenvalue problems and their applications in mathematics, physics, and engineering; systems of linear, ordinary, differential equations. Computer methods will be used. Prereq: C S 410; Math 527-528. 4 cr.

**646. ANALYSIS FOR APPLICATIONS**
Initial-boundary-value problems of mathematical physics; Sturm-Liouville problems; series expansions by orthogonal functions; Green's functions; numerical methods; Prereq: C S 410; Math 527-528. 4 cr.

**647. COMPLEX ANALYSIS FOR APPLICATIONS**
Complex numbers; complex integration; infinite series; contour integration; conformal mapping; Fourier and Laplace transforms; Wiener-Hopf techniques. Prereq: Math 528. 4 cr.

**656. INTRODUCTION TO NUMBER THEORY**
Unique factorization, linear and quadratic congruences, quadratic reciprocity law, arithmetic functions, quadratic forms, introduction to algebraic numbers. Prereq: Math 531. 4 cr.

**657. GEOMETRY I**
Advanced approach to fundamental properties of Euclidean geometry. Prereq: Math 531. 4 cr.

**658. GEOMETRY II**
Systems of postulates of various geometries, geometric invariants, synthetic and analytic projective geometry, introduction to non-Euclidean geometry. Prereq: Math 531. 4 cr. (Not offered every year.)

**682. NONLINEAR DIFFERENTIAL EQUATIONS**
Phase plane analysis of autonomous systems; critical points; limit cycles; periodic solutions; approximate methods for second-order nonlinear equations; stability and asymptotic behavior of solutions. Prereq: Math 527. 4 cr. (Not offered every year.)

**696. INDEPENDENT STUDY**
Projects of interest and value to student and department. Prereq: permission of faculty supervisor and department chairperson. 1-6 cr.

**698. SENIOR SEMINAR**
Study and reports on special topics. Prereq: senior standing in mathematics education. 4 cr.

**703. MATHEMATICS EDUCATION, K-6**
Psychological theories of teaching; elementary curriculum projects; laboratory approach in teaching; survey including history, present theories, education objectives, and research. Prereq: Math 621 or equivalent. 2-4 cr.

**735. PROBABILITY**
Sample spaces (discrete and continuous); random variables; conditional probability; moments; binomial, Poisson, and normal distributions; limit theorems for sums of random variables. Prereq: Math 528. 4 cr.

**736. STATISTICS**
Sampling theory, estimation of parameters, testing of hypotheses, nonparametric methods. Prereq: Math 735. 4 cr.

**737. DECISION THEORY AND BAYESIAN METHODS**
Utility, decision problems, prior and posterior distributions, sufficiency, estimation and hypothesis testing, linear models and sequential sampling. Emphasis on applications to business and economics. Prereq: Math 735. (Also offered as Econ 737.) 4 cr. (Not offered every year.)

**738. MULTIVARIATE ANALYSIS**
Multivariate distributions, convergence theorems, estimation and hypothesis testing, multivariate ANOVA, principal components, canonical correlations, discriminant analysis. Prereq: Math 735; either Math 645 or Math 762. 4 cr. (Not offered every year.)

**753. NUMERICAL METHODS AND COMPUTERS I**
Numerical analysis on computers; high-level languages, compilers; linear and nonlinear equations; interpolation, quadrature, curve fitting, system simulations, optimization techniques, finite elements, computer graphics. Selected algorithms programmed for computer solution. Prereq: C S 410; Math 426. 4 cr.

**754. NUMERICAL METHODS AND COMPUTERS II**
Computer solutions of ordinary and partial differential equations, finite differences vs. finite elements, eigenvalues and eigenvectors, algorithms for hidden-line graphics. Mathematical software. Prereq: C S 410; Math 527. 4 cr.

**761. ABSTRACT ALGEBRA**
Basic properties of groups, rings, fields and their homomorphisms. Prereq: Math 531. 4 cr.

**762. LINEAR ALGEBRA**
Vector spaces, linear transformations, matrices, determinants, dual spaces, eigenvalues, spectral and canonical decomposition theorems. Not for credit if credit received for Math 645. Prereq: Math 761. 4 cr.

**764. ADVANCED ALGEBRA**
Vector spaces, modules over principal ideal domains, structure of finitely generated modules, finite abelian groups, elementary theory of fields. Prereq: Math 761. 4 cr. (Not offered every year.)

**767. ONE-DIMENSIONAL REAL ANALYSIS**
Theory of limits, continuity, differentiability, integrability, series, uniform convergence. Prereq: Math 528; 531. 4 cr.

**768. ABSTRACT ANALYSIS**
Metric spaces, function spaces, theory of uniform limits. Prereq: Math 767. 4 cr. (Not offered every year.)

**769. MULTIDIMENSIONAL REAL ANALYSIS**
Partial derivatives, multiple integrals, line and surface integrals, Fourier series. Prereq: Math 767. 4 cr. (Not offered every year.)

**776. LOGIC**
Formal mathematics and formal systems. Consistency, completeness, decidability. Prereq: Math 531. 4 cr. (Not offered every year.)

**784. TOPOLOGY**
Connectedness, compactness, metrizability; with special emphasis on real line and plane. Prereq: Math 531. 4 cr.

**785. ALGEBRAIC METHODS IN TOPOLOGY**
Topology of manifolds, topological groups, homology, knot theory. Prereq: Math 784. 4 cr. (Not offered every year.)

**788. COMPLEX ANALYSIS**
Complex functions, sequences, limits, differentiability and Cauchy-Riemann equations, elementary functions, Cauchy's theorem and formula, Taylor's and Laurent's series, residues, conformal mapping. Not for credit if credit received for Math 647. Prereq: Math 767. 4 cr.

**791. MATHEMATICS EDUCATION**
Methods of teaching mathematics in the secondary school. Prereq: Educ 500. 4 cr.

## Computer Science (C S)

**403. INTRODUCTION TO DIGITAL COMPUTER PROGRAMMING**
Development of algorithms and programs. Basic programming and programming structure utilizing FORTRAN IV language; use of an operating system, computer solution of numerical and nonnumerical problems. Intended for chemical engineering majors. No credit toward a C S major. 2 cr.

**410. INTRODUCTION TO COMPUTER PROGRAMMING**
A set of three 2-credit modules. Introductory module, first half of the semester. Modules C and F, second half of the semester. Introductory module prerequisite for C and F. Permission required to register for less than 4 cr. 2-6 cr.

**410. Introductory Programming**
Basic concepts and programming; PASCAL or other high-level programming language.

**410C. Business Programming With Cobol**
Algorithms related to business data processing, such as merging and updating of files.

**410F. Scientific Programming With Fortran**
Common numerical algorithms and programming techniques; simple linked-list data structures; problems of error in numerical computation.

**611. ASSEMBLER-LANGUAGE PROGRAMMING**
Assembler-language coding and programming techniques. Data representation, systems organization, program segmentation, linkage of control section, manipulation of bits or bytes, micro- and macroprogramming. Input/output using System macros. Interrupts. Prereq: C S 410. 4 cr.

**612. DATA STRUCTURES AND PROCESSES**
Data structure programming techniques and program structure using a higher-level language. Linear lists, strings, arrays, trees, and graphs. Symbol tables, sorting and searching techniques. Data organization, record-oriented and stream-oriented data transmission, conversion techniques, and storage allocation. Prereq: C S 410. 4 cr.

**710. ADVANCED PROGRAMMING SYSTEMS**
Review of batch-process systems programs. Software organization; multiprogramming systems; techniques for parallel processing; multiaccessing and multiprocessing. Core management, file system design and management, and system accounting. Design of system modules and interfaces. Prereq: C S 611. 4 cr.

**711. PROGRAMMING LANGUAGES AND COMPILER CONSTRUCTION**
Formal definition of programming languages; specification of syntax and semantics. Global properties of algorithmic languages such as PL/I and ALGOL. Review of special purpose languages for list processing, symbol manipulation, data description and simulation; run-time representation of program and data structures; how these properties affect compilation. Prereq: C S 612. 4 cr.

**713. COMPUTER GRAPHICS**
Input-output and representation of pictures from hardware and software points of view; interactive techniques and their applications; development of an interactive graphics system. Prereq. permission. 4 cr.

## Mechanical Engineering (M E)

**Chairperson:** William Mosberg

**Professors:** E. Howard Stolworthy, emeritus; Robert W. Corell, Richard S. Davis, Godfrey H. Savage, Charles K. Taft, Asim Yildiz
**Associate Professors:** E. Eugene Allmendinger, Wayne M. Beasley, Barbaros Celikkol, Frederick C. Hochgraf, David E. Limbert, William Mosberg, Russell L. Valentine, John A. Wilson
**Assistant Professors:** Harvard B. Emery, emeritus; M. Robinson Swift
**Senior Research Fellow and Lecturer:** Musa Yildiz

**401. INTRODUCTION TO MECHANICAL ENGINEERING**
Goals and interactions of mechanical engineering in contemporary society. Basic concepts presented and developed as background for future coursework. Lectures, case studies, and laboratories. 4 cr.

**413. ENGINEERING GRAPHICS**
Analysis of engineering problems using fundamentals of engineering drawing for the communication of engineering information. This course is identical with the first half of M E 441 and ends at midsemester. Lab. 2 cr.

**414. ENGINEERING GRAPHICS**
Analysis of engineering problems using fundamentals of descriptive geometry. This course is identical with the second half of M E 441 and starts at midsemester Prereq: M E 413 or equivalent. Lab. 2 cr.

**441. ENGINEERING GRAPHICS**
Communication of engineering information and three-dimensional concepts by multiview drawings, pictorial views, sketches, and graphs; including the fundamentals of descriptive geometry. Lab. 4 cr.

**503. THERMODYNAMICS I**
Laws of thermodynamics and their relation to working substances. Prereq: Math 426. 4 cr.

**504. THERMODYNAMICS II**
Laws of thermodynamics and their application to real systems. Behavior of ideal and real media; thermodynamics of nonreactive and reactive mixtures; power and refrigeration cycles. Prereq: M E 503. 4 cr.

**505. INTRODUCTION TO THERMODYNAMICS AND HEAT TRANSFER**
First and second laws of thermodynamics; selected applications. Elementary topics in conductive, radiative, and convective heat transfer. Not for M E majors. Prereq: Math 425; Phys 407. 3 cr.

**508. FLUID DYNAMICS**
Dynamics and thermodynamics of compressible and incompressible fluid flow; behavior of fluids as expressed by hydrostatic, continuity, momentum, and energy equations. Prereq: M E 503; M E 527. 4 cr.

**525. MECHANICS I**
An introduction to statics. Two- and three-dimensional force systems, the concept of equilibrium, analysis of trusses and frames, centroids, bending moment and shear force diagrams, friction, and stress-strain relationships. Prereq: Math 425 and 426; Phys 407. 3 cr.

**526. MECHANICS II**
An introduction to strength of materials. Analysis of members under torsion, axial, shear and bending stresses, superposition of stresses, stability of columns. Prereq: M E 525. 3 cr.

**527. MECHANICS III**
An introduction to particle and rigid body dynamics. Rectilinear and curvilinear motion, translation and rotation, momentum and impulse principles, and work-energy relationships. Prereq: M E 525 or permission. 3 cr.

**541. MANUFACTURING PROCESSES AND DESIGN**
Manufacturing drawings, sketching basic mechanisms found in machine shops, operation of basic machine tools. Lab. 4 cr.

**561. INTRODUCTION TO MATERIALS SCIENCE**
Theoretical and experimental studies of the structure and properties of solids. M E 561L required concurrently or subsequently. 3 cr.

**561L. INTRODUCTION TO MATERIALS SCIENCE (LABORATORY)**
Companion laboratory to M E 561. Co- or prereq: M E 561 or equivalent. 1 cr.

**562. INTRODUCTION TO MATERIALS ENGINEERING**
Physics and chemistry of selected processes in materials technology. Phase transformations in ceramics and ferrous alloys, sintering, solidification, semiconductor device fabrication. Extended lab hours for plant visits. Lab. 4 cr.

**628. INTRODUCTION TO VIBRATIONS**
Theory and application of mechanical and system vibrations. Single and multiple degrees of freedom; free and forced systems; development of closed form or approximate solutions using mathematical techniques and the computer. Introduction to continuous systems. Prereq: M E 527 or equivalent. 3 cr.

**643-644. ELEMENTS OF DESIGN I AND II**
Synthesis, analysis, and design of machine components, and systems. Development of engineering judgment; selection of materials: kinematic arrangements; design factors; failure criteria; fluctuating loads; design for finite and infinite life; stress concentration; finite element method; statistical methods. Prereq: M E 525; M E 526; M E 527. 4 cr.

**648. INTRODUCTION TO MEASUREMENT AND EXPERIMENTAL METHODS**
Required for junior M E students. Experimental methods, transducers, signal-processing instrumentation, and experimental errors. Experiments involving the static and dynamic measurements and display of mechanical variables using typical mechanical and electrical transduction and signal handling methods. Prereq: junior standing. 3 cr.

**691. ECONOMIC DECISION MAKING IN ENGINEERING**
Economic optimization of engineering problems. Prereq: senior standing. 3 cr.

**695 A-D - 696 A-D. MECHANICAL ENGINEERING UNDERGRADUATE PROJECTS AND INDEPENDENT STUDY**
Course numbers refer to topics in A) Thermal Science; B) Solid Mechanics; C) Engineering Design; and D) Materials, respectively. 2-4 cr.

**697, 698. MECHANICAL ENGINEERING SEMINAR**
Study and discussion of engineering topics; student-faculty participation. 1 cr.

**701. MACROSCOPIC THERMODYNAMICS**
Thermodynamic principles using an analytic, postulational approach and Legendre transformations to obtain thermodynamic potentials. 4 cr.

**702. STATISTICAL THERMODYNAMICS**
Macroscopic thermodynamic principles developed by means of microscopic analysis. Prereq: M E 503. 4 cr.

**703. HEAT TRANSFER**
Analysis of phenomena; steady-state and transient conduction, radiation, and convection; engineering applications. Co- or prereq: M E 508. 3 cr.

**707. ANALYTICAL FLUID DYNAMICS**
Development of the Navier-Stokes equations; vorticity theorems; turbulence and boundary-layer theory. Prereq: M E 508. 4 cr.

**708. GAS DYNAMICS**
Basic equations of motion of one-dimensional, subsonic and supersonic flows of compressible, ideal fluids. Wave phenomena. Rankine-Hugoniot relations. Linear approach to two-dimensional flow problems. Prereq: M E 508. 4 cr.

**710. SOLAR HEATING SYSTEMS**
Analysis and computer modeling of solar radiation as an energy source for heating. Phenomena, availability, collection, performance, and economy of solar energy for heating systems. Prereq: M E 703. 3 cr.

**717. CRYOGENICS**
Phenomena and processes at very low temperatures. Basic engineering sciences applied to problems of low temperature refrigeration, liquefaction, separation, and storage; transport of cryogenic fluids; measurement systems; vacuum technology. Prereq: M E 503. 4 cr.

**723. ADVANCED DYNAMICS**
Classical dynamics oriented to contemporary engineering applications. Review of particle dynamics. Hamilton's principle and the Lagrange equations. Kinematics and dynamics of rigid bodies, gyroscopic effects in machinery and space structures. 4 cr.

**724. VIBRATION THEORY AND APPLICATION**
Discrete vibrating systems. Linear system concepts; single-degree-of-freedom systems with general excitation. Matrix theory and eigenvalue problems. Many degrees of freedom, normal mode theory for free and forced vibration. Numerical methods; introduction to continuous systems; applications to structural and mechanical systems. Prereq: M E 628. 4 cr.

**726. EXPERIMENTAL MECHANICS**
Experimental methods and theoretical bases applied to measurement of stress, strain, and motion. Transmitted and scattered-light photoelasticity; strain gage applications; brittle coating and grid techniques; dynamic measurements, and associated instrumentation. 4 cr.

**727. ADVANCED MECHANICS OF SOLIDS**
Beams on elastic foundation, curved bars, inelastic behavior, instability, introduction to thin plates and shells, introduction to elasticity, energy methods, and numerical methods. 4 cr.

**730. MECHANICAL BEHAVIOR OF MATERIALS**
Elastic and inelastic behavior of materials in terms of micro- and macromechanics. Stress, strain, and constitutive relations related to recent developments in dislocation theory and other phenomena on the atomic scale and to the continuum mechanics on the macroscopic scale. Elasticity, plasticity, viscoelasticity, creep, fracture, and damping, Anisotropic and heterogenous materials. 4 cr.

**737. OCEAN MECHANICS I**
Ocean as a continuous medium, its mechanical and thermodynamic properties. Shallow- and deep-ocean modeling for the investigation of gravity and sound waves. Ocean subbottom and its soil mechanical and sound propagation properties. Instrumentation, rudimentary data collecting and processing procedures, and computer usage. Prereq: M E 508; 525; 526; 527; Math 527; 528. 4 cr.

**738. OCEAN MECHANICS II**
Ocean dynamical laws generalized to include temperature and salinity variations in the water column. Conservation laws with generalized equation of state. Air-sea interaction, energy transport phenomena, reflection from different coastal geometry, harbor resonances, internal currents. Sound reflection from subbottom, sound probing techniques to determine subbottom properties by ray theory and generalization of subbottom soil from an elastic to a viscoelastic medium. Prereq: M E 737; M E 781 desirable but not required. 4 cr.

**741. FLUID CONTROL SYSTEMS**
Mathematical modeling of hydraulic, pneumatic, and fluidic control elements and control systems. Methods for: 1) analysis of systems using gases or liquids as the working fluid; 2) synthesis of the parameters of the control elements used in automatic control systems; 3) design of these systems. (Also offered as E E 741.) 4 cr.

**751. NAVAL ARCHITECTURE IN OCEAN ENGINEERING**
Selected topics in the fundamentals of naval architecture pertinent to ocean engineering, including hydrostatic characteristics, basics of resistance and propulsion and rules and regulations for surface, semisubmersible, and submersible marine vehicles. Computer applications. Prereq: M E 508; M E 525; /or permission. 4 cr.

**752. SUBMERSIBLE VEHICLE SYSTEMS DESIGN**
Conceptual and preliminary design of submersible vehicle systems; submersibles, environmental factors, hydromechanic and structural principles, materials, intra/extravehicle systems, operating considerations, predesign and design procedures. Design projects selected and completed by student teams. Prereq: permission. 4 cr.

**757. COASTAL ENGINEERING AND PROCESSES**
Introduction to small amplitude and finite amplitude wave theories. Wave forecasting by significant wave method and wave spectrum method. Coastal processes and shoreline protection. Wave forces and wave structure interaction. Introduction to mathematical and physical modeling. Prereq: M E 508 or permission. 3 cr.

**760. PHYSICAL METALLURGY I**
Introduction to the electron theory of metals, intermetallic compounds, ferromagnetism, dislocations, and slip phenomena. 4 cr.

**761. X-RAY DIFFRACTION**
Physics of X-ray diffraction, the reciprocal lattice, lattice parameter determinations, space group identification, phase identification, characterization of preferred orientation. Lab. 4 cr.

**763. MICROSTRUCTURE OF SOLIDS**
Basic concepts and measurements; statistically exact expressions for points, lines, surfaces, and volumes; random, partially oriented and oriented structures; particle and grain characteristics and distributions; projected images and shape specification; practical applications. 4 cr.

**766. PHYSICAL CERAMICS**
Characteristics of crystalline and noncrystalline ceramic solids; defect structures; diffusion in ceramic materials; nucleation, crystal growth, and solid-state reactions; kinetics of grain growth, sintering, and vitrification. 4 cr.

**771. DYNAMIC SYSTEMS MODELING**
Lumped parameter models for mechanical, electrical, fluid, thermal, and mixed systems. Time-domain solutions, frequency-response plots, matrix representations, eigen vectors, and eigenvalues are used to explore system response. Introduction to nonlinear analysis, simulation, computer applications. 3 cr.

**781. MATHEMATICAL METHODS IN ENGINEERING SCIENCE I**
Solution of discrete and continuous systems. Review of calculus, linear algebra, complex numbers, Fourier series, differential and partial differential equations with examples from acoustics, vibration theory, hydrodynamics, elasticity, solid mechanics, transport theory, and particle mechanics. 4 cr.

**782. CONTROL SYSTEMS**
Fundamental principles involved in the design and analysis of feedback control systems. Topics include stability criterion, time-domain analysis, frequency-domain analysis, and introduction to nonlinear systems. Lab. (Also offered as E E 782.) 4 cr.

**793 A-D - 794 A-D. SPECIAL TOPICS IN ENGINEERING**
Course numbers refer to topics in A) Thermodynamics; B) Mechanics; C) Engineering Design; and D) Materials, respectively. Content of these courses may vary from year to year. 2-4 cr.

**795 A-D - 796 A-D. INDEPENDENT STUDY**
Course numbers refer to topics in A) Thermal Science; B) Solid Mechanics; C) Engineering Design; and D) Materials, respectively. 2-4 cr.

# Medical Technology (MedT)

**Chairperson:** Karol A. LaCroix

**Assistant Professor:** Karol A. LaCroix
**Adjunct Assistant Professors:** John Beck, M.D., Denis J. Carlson, M.D., Kenneth R. Lee, M.D., Hillary Reid Newland, M.D.
**Instructor:** Sylvia Countway
**School of Medical Technology, Hanover, New Hampshire**
**Adjunct Assistant Professor:** E. Elizabeth French, M.D.
**Adjunct Clinical Instructor:** Elizabeth A. Ward
**Adjunct Lecturers:** Miriam K. Fogg, Joyce Gallagher, Christopher Probst, Robert Strohsahl

**401. INTRODUCTION TO MEDICAL TECHNOLOGY**
Functions and responsibilities of medical technology as a unit of the health team. Lectures, films, demonstrations, and field trips. Prereq: second-semester freshman or sophomore major standing. 0 cr.

**625. CLINICAL MICROSCOPY**
Identification and analysis of cellular elements of peripheral blood, bone marrow, and urine; review of hemostasis principles; their relationships to the body in health and disease. Prereq: Zool 507-508. Lab. 4 cr.

**696. INDEPENDENT STUDY**
In-depth studies under faculty supervision. Staff. Prereq: junior standing; approval of the major adviser and the faculty of the area concerned. 2-4 cr.

**720. CLINICAL MYCOLOGY-PARASITOLOGY**
Clinical laboratory identification and pathology of human mycology and parasitology infections. Classification and diagnosis of clinically significant viruses. Prereq: Micr 702. Lab. 4 cr.

**761. DIAGNOSTIC MICROBIOLOGY METHODS**
Processing, evaluating, and identifying clinical bacteriology, mycology, and parasitic specimens. Routine methodologies and special procedures such as fluorescent techniques, antibiotic sensitivity testing, and nosocomial infections. Senior MedT majors only. 8 cr.

**762. CLINICAL HEMATOLOGY**
Review of routine and special hematology procedures, manual and automated methods. Lab results analyzed and interpreted in relation to diseases of the white cells, red cells, and platelets. Senior MedT majors only. 6 cr.

**763. CLINICAL IMMUNOLOGY**
Clinical serological techniques involving agglutination, precipitin, and hemolysin reactions. Principles and procedures of serological tests for syphilis, mononucleosis, rheumatoid factor, ASO hepatitis, rubella, etc. Senior MedT majors only. 2 cr.

**764. CLINICAL CHEMISTRY**
Practice in the operation, evaluation, and maintenance of automated and manual chemistry systems. Laboratory analyses of steroids, carbohydrates, proteins, lipids, biliary systems, enzymes, blood gases, isotopes, homones, toxicology. Data analysis and quality control. Senior MedT majors only. 8 cr.

**765. CLINICAL IMMUNOHEMATOLOGY**
Routine and special blood bank principles and procedures. Proficiency in blood typing, antibody screening and identification, cross matching, record keeping, and component therapy. Senior MedT majors only. 6 cr.

**766. CLINICAL URINALYSIS**
Laboratory examination of urines and other body fluids using routine and special determinations. Senior MedT majors only. 2 cr.

# Microbiology (Micr)

**Chairperson:** Galen E. Jones

**Professors:** Lawrence W. Slanetz, emeritus; William R. Chesbro, Galen E. Jones, Theodore G. Metcalf
**Associate Professors:** Thomas G. Pistole, Robert M. Zsigray
**Assistant Professors:** David L. Balkwill, Richard P. Blakemore

**501. PUBLIC HEALTH MICROBIOLOGY**
Cause, nature, incidence, and control of human communicable diseases. Microbiology and public health aspects of water, wastewater disposal, foods, and air. Lab (502) optional. 3 cr.

**502. PUBLIC HEALTH MICROBIOLOGY LABORATORY**
Laboratory techniques for identification of important pathogenic microorganisms, disease diagnosis, and bacteriological examination of water, wastewater, food, and air. (Students should register for Micr 501 concurrently.) 1 cr.

**503. GENERAL MICROBIOLOGY**
Principles of microbiology; morphology, physiology, genetics, and classification of bacteria and other microorganisms, and their relationships to agriculture, industry, sanitation, and infectious diseases. Prereq: Chem 401-402 or equivalent. Lab. 4 cr.

**600. ENVIRONMENTAL MICROBIOLOGY**
Detection, identification, and regulation of microorganisms which enhance or deteriorate the immediate human environment. Prereq: Micr 503. Lab. 4 cr.

**701. TAXONOMY AND ECOLOGY**
Isolation, identification, and classification of prokaryotic microorganisms by classical and newer techniques; analysis of the interplay between organism and environment based on energy metabolism and use of this to deduce a natural classification; uses of taxonomic and ecological information. Prereq: Micr 503; Bchm 601 or 656. Lab. 4 cr.

**702. PATHOGENIC MICROBIOLOGY**
Morphological, cultural, biochemical, serological, and pathogenic characteristics of microorganisms causing human and animal diseases. Prereq: Micr 503. Lab. 4 cr.

**704. MICROBIAL GENETICS**
Expression and transfer of genetic elements (chromosomal and nonchromosomal) in prokaryotic and eukaryotic microorganisms; consideration of factors influencing public health, industry, the environment, and society. Prereq: Micr 503; Bchm 601 or 656. Lab. 4 cr.

**705. IMMUNOLOGY AND SEROLOGY**
Defensive elements possessed by humans and animals protected against infectious microorganisms. Principles of serological techniques for recognition and identification of biological materials including microorganisms. Preparation of vaccines and production of antisera in animals. Prereq: Micr 702; permission. Lab. 4 cr.

**706. VIROLOGY**
Viruses, including animal and bacterial, and rickettsiae; interaction of viruses and host cells; techniques for propagation and recognition including immunologic methods; applications to infectious disease, the environment, and cancer. Prereq: Micr 702; permission. Lab. 4 cr.

**707. MARINE MICROBIOLOGY**
Characterization of microorganisms in the sea including taxonomy, physiology, and ecology; sampling, enumeration, distribution; and effects of marine environment upon microbial populations. Prereq: Micr 503 and organic chemistry. Lab. 4 cr.

**708. MICROBIAL BIOGEOCHEMISTRY**
Geochemical processes influenced by biochemical processes catalyzed by marine and terrestrial microorganisms; transformations of carbon, nitrogen, and other elements. Petroleum microbiology, natural gas production, sulfur formation, ferromanganese nodules, corrosion, and fossil microorganisms. Prereq: Micr 503 and organic chemistry. Lab. 4 cr.

**709. MICROBIAL CYTOLOGY AND ULTRASTRUCTURE**
Ultrastructure of prokaryotic and eukaryotic microorganisms. Structure and function of bacterial flagella, pili, walls, membranes, mesosomes, and cytoplasmic inclusions. Cytological features of structurally unique groups of bacteria, yeasts, fungi, and protozoa. Prereq: Micr 503. 2 cr.

**710. MICROBIAL CYTOLOGY LABORATORY**
Light and electron microscopic techniques for the study of microbial cytology: theory and use of the electron microscope, sample preparation methods, photomicrography and photographic darkroom techniques, interpretation of electron micrographs. Prereq: Micr 503; Micr 709 or concurrent registration; permission. Lab. 3 cr.

**712. SOIL MICROBIOLOGY**
Microbial ecology of the soil environment; characteristics of major microbial groups in soil; factors affecting activity of soil microorganisms; their effects on the environment; and biological interactions which involve them. Prereq: Micr 503. Lab. 4 cr.

**795, 796. PROBLEMS IN MICROBIOLOGY**
Prereq: permission. 1-8 cr.

# Military Science (Milt), Reserve Officers Training Corps

**Professor of Military Science:** Lieutenant Colonel William C. Hazen
**Lecturers:** Major David B. Bradley, Major Raymond W. O'Keefe, Captain Robert Corliss, Captain Donald Fowler
**Administrative:** Captain Lester R. Bowen, Jr., administrative officer; Sergeant Major George B. Fasulo, chief enlisted instructor; Master Sergeant Arthur Brooks, operations assistant; Sergeant First Class George Sweat, chief administrative assistant; N. E. Bernier, military property officer

**413. THE DEFENSE ESTABLISHMENT AND NATIONAL SECURITY I**
United States defense establishment and its role in national security. U.S. Army and its role in relation to other armed services and to civilian control of the military. Lab (required only of cadets). 1 cr.

**414. THE DEFENSE ESTABLISHMENT AND NATIONAL SECURITY II**
Major Army commands and the roles of separate operating agencies; organization and composition of combat units. Lab (required only of cadets). 1 cr.

**525. AMERICAN MILITARY HISTORY I**
Study of the development of American military institutions, strategy, traditions and civil-military relations in war and peace from the colonial period to 1898. 2 cr.

**526. AMERICAN MILITARY HISTORY II**
The institutions and policies of the military during the 20th century as its role shifts from defense to prevention of war. 2 cr.

**632. MILITARY LEADERSHIP AND MANAGEMENT**
Human relations, interpersonal communications, and group interaction. Authoritarian vs. participative leadership, self-actualization and fulfillment. Theory of teaching methods; examination of leadership models. Lab (required only of cadets). 4 cr.

**641. SEMINAR ON LEADERSHIP AND MANAGEMENT**
Military team concept and the coordination and planning necessary between elements of the team; analysis of contemporary problems; discussion of military justice system. 4 cr.

# Music

**Chairperson:** Paul F. Verrette

**Professors:** Karl H. Bratton, emeritus; Donald E. Steele, John D. Wicks
**Associate Professors:** Irving D. Bartley, emeritus; Mark B. DeVoto, Ruth S. Edwards, Alan Grishman, Stanley D. Hettinger, Cleveland L. Howard, Keith Polk, Mary H. Rasmussen, John E. Rogers, David E. Seiler, W. Niel Sir, Paul F. Verrette, John B. Whitlock, Henry J. Wing, Jr.
**Assistant Professors:** Robert Stibler, Peggy Vagts
**Lecturers:** Donald Bravo, Ben Clinesmith, Audrey A. Havsky, Steven Norsworthy, John Skelton

## History, Literature, and Appreciation (Musi)

**401. INTRODUCTION TO MUSIC**
Fundamental approach to perceptive listening, based on a detailed study of several masterpieces representing different periods and forms. Historical perspective, but main emphasis is on confronting significant works of musical art on their own terms. Some participation in musical life of the University required. Not open to music majors. 4 cr.

**402. SURVEY OF MUSIC HISTORY**
Historical development of musical style in relation to the whole fabric of Western civilization. Prereq: Musi 401. Not open to music majors. 4 cr.

**501-502. HISTORY AND LITERATURE OF MUSIC**
Styles, forms, and techniques of composition in Western music. Required of all music majors. 4 cr.

**511. SURVEY OF MUSIC IN AMERICA**
From colonial times to the present, including the various European influences, the quest for an American style, and the emergence of such indigenous phenomena as jazz. 4 cr.

**513. INTRODUCTION TO THE MUSIC OF AFRICA AND ASIA**
Folk and classical music of various ethnic cultures, particularly those of Japan, Indian, and sub-Saharan Africa. 4 cr.

**595. SPECIAL TOPICS IN MUSIC LITERATURE**
Open to music majors and nonmajors; topics in areas not easily covered in historical courses. May be repeated for credit. Prereq: permission. 1-4 cr.

**701. MUSIC OF THE MEDIEVAL PERIOD**
Nature of the beginnings of polyphony. The preeminent influence of the church in the 13th century and the rising secular movement in the 14th. Music as a dominant force in the political and social life of the Middle Ages. 4 cr.

**703. MUSIC OF THE RENAISSANCE**
Works of the 15th- and 16th-century composers from Dunstable to Palestrina. 4 cr.

**705. MUSIC OF THE BAROQUE**
Music of Europe from de Rore to Bach. 4 cr.

**707. MUSIC OF THE CLASSICAL PERIOD**
Growth of musical styles and forms from early classical, baroque-influenced composers through the high classicism of Haydn and Mozart, to the budding romanticism of the young Beethoven. Representative symphonies, concerti, and operas will be heard. 4 cr.

**709. MUSIC OF THE ROMANTIC PERIOD**
Symphonies, concerti, chamber music, and keyboard works of Beethoven, Berlioz, Schubert, Mendelssohn, Schumann, Brahms, Franck, Chopin, and Liszt. Romantic elements contained in the development of harmony, orchestration, sonority, expressive content. Rise of the short piano piece, the German art song, the symphonic poem, nationalism in music. 4 cr.

**711. MUSIC OF THE 20th CENTURY**
Contemporary music, including its literature, its trends, and an analysis of techniques, styles, forms, and expression. 4 cr.

**721. THE LIFE AND WORKS OF BEETHOVEN**
Piano sonatas, concerti, symphonies, and string quartets; a logical course after Musi 401 or Musi 501-502. 4 cr.

**732. THE ART SONG**
History and literature of the song with piano accompaniment. Survey of national styles of the 19th and 20th centuries and deeper study of the central core of the art song—the German Lied. 4 cr.

**733. SURVEY OF OPERA**
Representative masterpieces of this art form through listening, reading, and discussion. 4 cr.

**735. SURVEY OF PIANOFORTE LITERATURE**
Keyboard literature from Bach to the present. Discussions and performance (by the instructor) of works of Bach; sonatas and concerti of Haydn, Mozart, Beethoven, Schubert, the romantic composers, and of contemporary writers; a logical course after Musi 401 or Musi 501-502. 4 cr.

**795. SPECIAL STUDIES IN MUSIC**
A) J.S. Bach; B) Franz Schubert; C) Debussy and Ravel; D) The World of Jazz; E) The Iconography of Western European Musical Instruments; F) 19th-Century French Music; G) Advanced Analysis; H) Advanced Study in Electronic Music; I) Composition through Computer-generated Sound; J) Woodwind Literature; K) Brass Literature; L) String Literature; M) Medieval Performance Practice; N) Renaissance Performance Practice; O) Baroque Performance Practice; P) Classical Performance Practice; Q) 19th-Century Performance Practice; R) 20th-Century Performance Practice; S) Woodwind Repair; T) String Repair; U) Advanced Jazz Improvisation; V) Advanced Piano Pedagogy; W) Advanced Accompanying; X) Advanced Conducting; Y) Independent Study. Prereq: permission. May be repeated for credit with permission. 1-4 cr.

## Performance (Musi)

Registration for musical organization courses should be completed during the registration period. All music laboratory courses may be repeated. A maximum of 8 credits earned in music laboratory may be used toward graduation.

Private lessons are based on half-hour individual instruction per week. One semester hour credit may be earned with one lesson per week; two or four semester hours of credit may be earned with two lessons per week (only students in the Bachelor of Music curcirulum are allowed to register for four credits). Five one-hour

practice periods are expected for each credit of private study. The special semester fee for lessons is $35 per half-hour lesson (this fee applies for courses numbered 541 through 550). The fee includes the use of a practice room for the required preparation.

Registration in courses of private instruction is open to all students in the University, subject to approval by the Department of Music and the instructor. Enrollment is limited in these courses. Students may register for credit in successive semesters.

**441. CONCERT CHOIR—TECHNIQUES AND LITERATURE**
Study and performance of the best classical and modern choral literature. Recommended for voice majors. Open to all students. Prereq: permission. 1 cr.

**442. CHAMBER CHORUS**
A mixed chorus which studies and performs sacred and secular works from the Renaissance to the present, participates with the opera workshop and with the orchestra, and serves as a nucleus for larger choral-instrumental work. Prereq: permission. 1 cr.

**443. WOMEN'S CHORUS**
Open to all students interested in singing the finest literature in this medium who can fulfill the requirement of an audition. 1 cr.

**444. THE NEWHAMPSHIREMEN**
The male chorus of the University. Recommended for all male voice majors. Prereq: permission and audition. 1 cr. Cr/F.

**445. SUMMER SESSION CHORUS AND BASIC CONDUCTING**
Study and performance of the best classical and modern choral literature. Basic elements of choral conducting for elementary and secondary teachers, church choir directors, and those interested in singing. May be repeated. 1 cr.

**448. OPERA WORKSHOP**
Operatic singing, acting, and production techniques; performance of both complete operas and operatic excerpts. Prereq: permission. 1 cr.

**450. SYMPHONY—TECHNIQUES AND LITERATURE**
Presents several concerts during the year, of repertoire ranging from the great, standard symphonic literature to experimental, multi-media composition. Prereq: permission of conductor and audition. 1 cr.

**451. UNH TRAINING ORCHESTRA**
Designed for music education majors but open to all who wish to develop proficiency on major or secondary instruments. Ensemble experience in the basic repertoire often met in school situations for students who do not yet meet the standards required for the UNH Symphony. 1 cr.

**452. UNH SYMPHONIC WIND ENSEMBLE**
Open to all students. Campus concerts and New England tour. Prereq: permission and audition. 1 cr.

**453. UNIVERSITY BAND**
Original band music, transcriptions, marches, etc. For students whose program does not permit music as a major interest but who are interested in maintaining their playing proficiency and continuing their study of music. Prereq: permission. 1 cr.

**454. UNH MARCHING BAND**
Open to all students; performs during home and away football games. Rehearsals conclude at the end of the football season. Prereq: permission. Students planning to remain in the band program after football season should register for Musi 452 or 453. 0 cr.

**455. PIANO ENSEMBLE—TECHNIQUES AND LITERATURE**
Drawing from available student instrumentalists and singers, pianists learn the art of performing in trios, duo sonatas, and two-piano works, and gain experience in Lieder accompaniment. 1 cr.

**456. STRING ENSEMBLE—TECHNIQUES AND LITERATURE**
**457. WOODWIND ENSEMBLE—TECHNIQUES AND LITERATURE**
**458. BRASS ENSEMBLE—TECHNIQUES AND LITERATURE**
**459. PERCUSSION ENSEMBLE—TECHNIQUES AND LITERATURE**
**460. JAZZ ENSEMBLE—TECHNIQUES AND LITERATURE**
In these five courses, groups of instrumentalists gain experience in the performance of literature for the smaller ensemble. Prereq: permission. 1 cr.

**467. FUNCTIONAL PIANO**
Basic instruction for music majors with no previous keyboard training. Pianoforte technique, keyboard harmony geared to the practical harmonization of simple melodies, sightreading, transposition, and modulation. May involve both class instruction and periodic short individual lessons. Prereq: permission. 1 cr.

**541. VOICE**
**542. PIANO**
**543. HARPSICHORD**
**544. ORGAN**
**545. VIOLIN, VIOLA**
**546. VIOLONCELLO, STRING BASS**
**547. WOODWIND**
**548. BRASS**
**549. PERCUSSION**

**550. HARP** (Offered by special arrangement with the department.) In courses 541 through 550 (private instruction in performance) presentation and material used vary with pupil. Emphasis on musical values and sound technique. As the student advances, repertory is broadened to include works of all periods. One solo performance each semester may be required. Prereq: permission. 1 or 2 lessons; 1, 2, or 4 cr.

**751-752. CONDUCTING METHODS**
Physical aspects, equipment of conductor, fundamental gestures and beats, baton techniques. Reading and analysis of full and condensed scores, study of transposition, psychology of rehearsal. Prereq: Musi 571-572 and junior standing. 2 cr.

**754. COLLEGIUM MUSICUM**
Instrumentalists and singers perform small ensemble music from all periods, with emphasis on Renaissance and baroque music. Prereq: permission. 1 cr.

## Theory and Composition (Musi)

**471-472. THEORY I**
Introduction to the tonal system; principles of voice leading and harmonic progression through the analysis, realization, and composition of one-, two-, and four-voiced textures. Concept of triad inversion and consonant diatonic harmonies of the major and minor modes. Students should register for 473-474 concurrently. Prereq: permission. 3 cr.

**473-474. EAR TRAINING I**
Laboratory exercises to develop aural skills; sight-singing and dictation. Students should register for Musi 471-472 concurrently. Prereq: permission. 1 cr.

**571-572. THEORY II**
Continuation of Musi 471-472. Compositional and analytic work stresses the treatment of dissonance within the tonal system; accessory tones, seventh chords, tonicization, modulation, basic principles of chromatic harmony, and harmonization of chorale melodies are covered. Students should register for 573-574 concurrently. Prereq: Musi 472, 474; permission. 3 cr.

**573-574. EAR TRAINING II**
Laboratory exercises to further develop aural skills. Students should register for Musi 571-572 concurrently. Prereq: Musi 472, 474; permission. 1 cr.

**771-772. COUNTERPOINT**
Contrapuntal techniques of tonal music. Melodic construction and dissonance treatment through work in species counterpoint and studies in harmonic elaboration and prolongation. Analysis of selected compositions emphasizes the connection between fundamental contrapuntal techniques and the voice-leading of composition. Prereq: Musi 572 or permission. 2 cr.

**773. ADVANCED COUNTERPOINT**
Continuation of Musi 772. Prereq: Musi 772 or permission. 2 cr.

**775-776. COMPOSITION**
Construction of phrases, periods, and short compositions following classical models. Problems of text-setting. Prereq: Musi 572 or permission. 3 cr.

**777. ADVANCED COMPOSITION**
Continuation of Musi 776. Individual compositional projects. Prereq: Musi 776 and permission. May be repeated for credit. 3 cr.

**779. ORCHESTRATION**
Characteristics of band and orchestral instruments both individually and in small (homogeneous) and large (mixed) groupings. Students study scores, write arrangements, and have arrangements performed if at all possible. Some aspects of vocal writing. Prereq: Musi 572 or permission. 4 cr.

**781. FORM AND ANALYSIS**
Formal and textural elements; concepts and examples. Thorough analysis of smaller and larger masterworks from the standpoint of harmony, counterpoint, structural line, and formal articulation. Prereq: Musi 572 or permission. 4 cr.

**785. ELECTRONIC SOUND SYNTHESIS**
Part I: "traditional" or "analog" electronic sound synthesis; work with the Buchia Synthesizer in the electronic music studio. Part II: 1) elementary programming in FORTRAN, 2) the logic of computer sound syntheses, and 3) programming in MUSIC 4BF. Students will have the opportunity to run programs on a DEC KL10 computer equipped with 4-channel digital-to-analog and analog-to-digital converters. Part III: completion of a major independent study project in electronic music. Prereq: permission. 4 cr.

## Music Education (MuEd)

**500. EXPLORING MUSIC TEACHING**
Introductory fieldwork course for students to explore music teaching as a career. Observation, teaching, research, examination of multi-mechanical aids for music curriculum development. 2 cr.

**540. BEGINNING TECHNIQUES IN VOICE**
Basic techniques of voice production. Individual work is emphasized. Working knowledge of an instrument required. This course is desirable for, but not restricted to, MuEd majors. Prereq: permission. 2 cr.

**545, 546. BEGINNING TECHNIQUES IN STRING INSTRUMENTS**
Class and individual instruction. Four hours practice per week. Training on the violin, viola, and cello. Classroom procedures, establishment of string programs, and evaluation of available methods materials. 2 cr.

**595. SPECIAL PROJECTS IN MUSIC EDUCATION**
Individual investigation, research, or study. Creative projects may be included. Prereq: permission. 1-4 cr.

**741-742. TECHNIQUES AND METHODS IN CHORAL MUSIC**
Problems in the organization and performance of high school, college, and community choruses. Techniques of choral conducting and rehearsal, repertory, and materials. 2 cr.

**743. MATERIALS AND METHODS IN PIANO MUSIC**
Gives potential piano teachers a coherent but flexible approach to the instruction of students of different ages and levels of talent through evaluation of methods and materials and discussion of the role of the private teacher. 2 cr.

**745-746. TECHNIQUES AND METHODS IN STRING INSTRUMENTS**
Class and individual instruction. Four hour practice per week required. Intensive training on the violin, viola, cello, and double bass, enables participants to perform in string ensembles. Classroom procedures, establishment of string programs, and evaluation of available methods materials. 2 cr.

**747-748. TECHNIQUES AND METHODS IN WOODWIND INSTRUMENTS**
Basic fundamentals of performance, class instruction, associated acoustical problems and study of woodwind literature. First semester: clarinet, flute, and saxophone. Second semester: double-reed instruments. 2 cr.

**749. TECHNIQUES AND METHODS IN BRASS INSTRUMENTS**
Basic course in embouchure formation, tone, tonguing, fingering, flexibility, accuracy, and range development as applied to the trumpet or baritone horn, French horn, and trombone; methods, studies, solos, and ensembles most likely to be useful with grade school, junior high school, and high school players of brass instruments. 2 cr.

**751. TECHNIQUES AND METHODS IN PERCUSSION INSTRUMENTS**
Basic performance skills on snare drum, timpani, mallet instruments, and other percussion instruments used in bands and orchestras. Materials and methods of instruction. 2 cr.

**785. MUSIC FOR THE ELEMENTARY CLASSROOM TEACHER**
Designed for the nonspecialist. Correlation and integration of music in the school curriculum, and basic skills and techniques necessary. 4 cr.

**787-788. THE TEACHING OF ELEMENTARY AND MIDDLE SCHOOL MUSIC**
Aims, scope, and organization of materials and activities in elementary and middle schools. Modern trends in educational philosophy; development of the child's voice; demonstration of materials and methods for the various grades. Observation and teaching in schools. 2 cr.

**791-792. THE TEACHING OF SECONDARY SCHOOL MUSIC**
Educational principles applied to music teaching and learning; curriculum organization for junior and senior high school. Adolescent voice, voice classification, selection of vocal and instrumental materials, and building unified concert programs. Problems of administration; management; relationship of the teacher to school and community. Observation of secondary school music programs. 2 cr.

**795. SPECIAL STUDIES IN MUSIC EDUCATION**
Allows upper-level students to explore individually or in groups areas related to their specific professional interests. Prereq: permission. 1-4 cr.

**796. ORGANIZATION AND ADMINISTRATION OF SCHOOL MUSIC GROUPS**
Problems of organizing and administering school orchestras, bands, glee clubs, choruses, and small ensembles; objectives, motivation, schedule, discipline, equipment, programs, finances, rehearsal techniques, contests and festivals, materials, personnel selection, and grades. 4 cr.

# Nursing (Nurs)

**Chairperson:** Andrea R. Lindell

**Associate Professors:** Mary L. Fernald, emerita; Marguerite F. Fogg, B. Ann Kelley, Andrea R. Lindell, Juliette D. Petillo, Rosemary Y. Wang
**Assistant Professors:** Joyce B. Barker, Patricia G. Dean, Evelyn P. Fitzpatrick, Sarah C. Hubbard, Margaret A. Rice, Martha W. Rowe, Carol L. Williams
**Instructors:** Jan Bennett, Gwenyth G. Gerhard, Susan C. Millar, Heidi E. Shealy
**Lecturers:** Ruth A. Eichell, Helen B. Langton
**Adjunct Assistant Professor:** Ann Batchelder

**402. NURSING**
Current trends and issues in nursing. Personal beliefs and understandings related to practice and nursing. Significance of interpersonal and technical skills in nursing practice. Nurs majors only. 2 cr.

**404. SUICIDOLOGY**
Introductory course in the study of self-destructive behaviors and suicide: epidemiologic and demographic variables, theories of death and dying, related research. Emphasis on prevention, assessment, intervention, and postvention in suicide risk. Open to all students. 4 cr.

**550. NURSING MANAGEMENT**
Provides a base for understanding the concepts, principles, and skills needed to function as a nurse manager. Content includes the following functions of nursing management: planning, organizing, staffing, influencing, and controlling. 4 cr.

**601. NURSING PROCESS**
Concepts and theories related to nursing process applied to man—a bio-psycho-social being. Laboratory experiences; application of process to well individuals throughout the life cycle; focus on maintaining health in the community setting. Prereq: junior standing; Nurs major. Variable credits available only to EBORN students. 1-6 cr. (EBORN), 6 cr (non-EBORN).

**603. NURSING PROCESS APPLIED TO WELL FAMILY**
Maintaining family health under normal stresses and adaptation to change. Laboratory experience: health maintenance of an assigned expanding family. Prereq: junior standing; Nurs major. Variable credits available only to EBORN students. 1-6 cr. (EBORN), 6 cr. (non-EBORN).

**610. NURSING PROCESS DEALING WITH ENVIRONMENTAL INFLUENCES ON MAN AND NURSING**
Health care delivery system as it relates to: limited illness, leadership, change, and research. Nursing interventions with clients experiencing injuries from mechanical, thermal, chemical, and occupational stress. Laboratory experiences in hospitals and communities. Prereq: Nurs 601; 603; Nurs major. Variable credits available only to EBORN students. 1-6 cr. (EBORN), 6 cr. (non-EBORN).

**612. NURSING PROCESS IN LIMITED DISRUPTIONS OF MAN'S WELLNESS**
Nursing process applied to individuals and families coping with surgical, inflammatory, and childbearing stresses; maintenance of the transport system, internal chemical environment, and comfort. Laboratory experiences in hospitals and the community to increase understanding and proficiency. Prereq: Nurs 601; 603; Nurs major. Variable credits available only to EBORN students. 1-6 cr. (EBORN), 6 cr. (non-EBORN).

**621. NURSING PROCESS IN COMPLEX DISRUPTIONS OF MAN'S WELLNESS**
Nursing process applied to complex bio-psycho-social disruptions and/or life-threatening situations in man's wellness at all developmental levels. Prereq: Nurs 610; 612; Nurs major. Variable credits available only to EBORN students. 1-6 cr. (EBORN), 6 cr. (non-EBORN).

**625. NURSING PROCESS DEALING WITH COMPLEX ENVIRONMENTAL INFLUENCES ON MAN AND NURSING**
Nursing process applied to complex external stimuli affecting man and nursing; multiple environmental and societal factors contributing to disruptions in man's wellness. Prereq: Nurs 610; 612; Nurs major. Variable credits available only to EBORN students. 1-6 cr. (EBORN), 6 cr. (non-EBORN).

**628. NURSING PROCESS IN MAINTAINING MAN'S OPTIMUM FUNCTION IN SOCIETY**
Nursing process; collaboration and coordination within the health team to assess and promote functional health potentials of individuals at all developmental stages. Prereq: Nurs 621; 625; Nurs major. Variable credits available only to EBORN students. 1-8 cr. (EBORN), 8 cr. (non-EBORN).

**630. THE DYNAMICS OF ADDICTION**
Dynamics of addiction from the viewpoint of a disease process. Reasons for and treatments and implications of addiction to drugs, alcohol, and other bodily stimuli. Cause and effect relationship involved in addiction examined from the perspectives of the individual and society. Role implications for health care providers in relation to prevention and treatment. Prereq: senior standing major; /or permission. 4 cr.

**640. QUALITY ASSURANCE IN NURSING**
Current trends toward quality assurance in fields of health and nursing; approaches to assessment and implementation of quality assurance programs in various practice settings. Prereq: senior standing major; /or permission. 4 cr.

**695. INDEPENDENT STUDY**
In-depth study with faculty supervision. Prereq: junior standing and approval of adviser and faculty of the area concerned. 2-4 cr.

# Occupational Education (OcEd)

**Chairperson:** Nicholas L. Paul

**Professors:** Samuel W. Hoitt, emeritus; William H. Annis, Maynard C. Heckel
**Associate Professors:** Jesse James, emeritus; Richard L. Barker, Nicholas L. Paul, Lewis Roberts, Jr.
**Assistant Professor:** Gregory D. Gill
**Thompson School Assistant Professor:** Thomas A. March

**415. PRINCIPLES AND PRACTICES OF AGRICULTURAL CONSTRUCTION AND MECHANIZATION**
A) Metals—Technology and Fabrication I; B) Metals—Technology and Fabrication II; C) Residential Carpentry; D) Residential Electricity; E) Internal Combustion Engines—Principles and Maintenance; F) Internal Combustion Engines—Repair and Overhaul. Concentration of time on understanding the skills required, with some opportunity to observe and develop techniques for teaching and/or development of agricultural construction and mechanization programs. Prereq: permission. May be repeated up to 12 cr. 2 cr.

**440. CONCEPTS OF CAREER EDUCATION**
Examines the four major roles of people and how these roles apply to learning in University classes. The four roles are: 1) family member; 2) citizen; 3) worker; and 4) user of leisure time. This permits students to develop flexibility for changes that may occur in the future. Through this concept of career education students develop skills to: 1) use the concept as a teaching or learning strategy; 2) explore their individual areas for improvement; 3) relate their present and future classes to employment; and 4) enter the world of work. 4 cr.

**500. OCCUPATIONAL COMPETENCY EXAMINATION AND EVALUATION**
Examination and/or evaluation to determine the level of competency within occupational clusters. Restricted to OcEd majors. Prereq: permission. 0-30 cr. Cr/F.

**550. PRINCIPLES OF OCCUPATIONAL EDUCATION**
An examination of the principles on which occupational education and the Cooperative Extension Service are based. Includes historical and legislative development at both the state and federal levels with emphasis on current issues and problems. Required for majors and minors in OcEd. 4 cr.

**650. MICROTEACHING**
Organization and presentation of microlessons. Preliminary experience and practice in teaching. Variables of classroom teaching under controlled conditions. Substitutes for Educ 703. Videotaping for immediate feedback. Required for majors and minors in OcEd. Prereq: Educ 500 or permission. 1-4 cr.

**695. INVESTIGATIONS IN OCCUPATIONAL EDUCATION**
A) Career Education; B) Secondary Education; C) Postsecondary Education; D) Adult Education; E) Extension Education; F) Exemplary Education; G) Cooperative Education; H) Disadvantaged and Handicapped Education. An opportunity for undergraduates to address a special problem. Prereq: permission. May be repeated. 2-4 cr.

**696. FIELD EXPERIENCE**
Work with an agency, institution, or organization to gain technical and/or professional competence not otherwise available. Student plans experience with departmental adviser. Credit approval subject to recommendation of faculty members and performance of student. Limited to OcEd majors and minors. Prereq: permission. May be repeated up to 16 credits. 2-16 cr.

**700. WORKSHOPS IN OCCUPATIONAL EDUCATION**
Modularized instruction for in-service education of teachers of vocational education and others in occupational education. May be repeated up to 8 credits. 1-2 cr.

**750. SHOP ORGANIZATION AND CONTROL METHODS**
Purposes: 1) to examine all facilities of vocational programs in New Hampshire to insure safety, quality instruction, and adequate usage of space; 2) to examine the role of the vocational instruction relating to liability, maintenance of equipment, planning for improvements in facilities, and planning for new facilities. 4 cr.

**783. PREPARATION FOR CONDUCTING AND SUPERVISING ADULT-EDUCATION PROGRAMS**
Techniques of needs identification, program planning, teaching methods, supervision, and evaluation. Prereq: OcEd 550 or permission. 4 cr.

**784. THE COMMUNITY-JUNIOR AND VOCATIONAL-TECHNICAL COLLEGES**
Rise and development of community-junior colleges and two-year vocational-technical colleges in American education; their history, potential, philosophy, and functions. 4 cr.

**785. ADVANCED METHODS AND MATERIALS OF INSTRUCTION**
Organization of competency based instruction to meet student needs. Development and use of resource files, instructional materials, and student evaluation. Open to teachers of vocational-technical education and others by permission. Required of master's degree candidates. 4 cr.

**786. CONCEPTS OF OCCUPATIONAL EDUCATION**
Development of vocational-technical education in the U.S.; socio-economic influences responsible for its establishment. Federal and state requirements for secondary and post-secondary schools. Coordination of programs with general education and other vocational fields. Required of master's degree candidates. 4 cr.

**787. ADMINISTRATION AND SUPERVISION OF VOCATIONAL EDUCATION**
Special competencies required and operating philosophies examined for supervision and administration in the several areas of vocational education. 4 cr.

**791. PLANNING FOR TEACHING**
Organization of materials of instruction to meet group and individual needs. Techniques of instruction, planning for teaching, function of consulting committees, working with youth groups, program evaluation. Course scheduled concurrently with Educ 694. Prereq: OcEd 650. 4 cr.

**796. INVESTIGATIONS IN OCCUPATIONAL EDUCATION**
A) Career Education; B) Secondary Education; C) Post-Secondary Education; D) Adult Education; E) Extension Education; F) Exemplary Programs; G) Cooperative Education Programs; H) Disadvantaged and Handicapped Education Programs. Student-selected problems in one of the areas listed. Elective after consultation with the instructor. Hours to be arranged. May be repeated. 2-4 cr.

**798. OCCUPATIONAL EDUCATION SEMINAR**
Discussion of current issues, problems, and research and development in OcEd. Students, faculty, and other personnel serve as discussion leaders. Required of OcEd majors and minors. 0 cr.

# Occupational Therapy (OT)

**Chairperson:** Barbara Sussenberger

**Associate Professors:** Barbara Sussenberger, Ann D. Ury, Judith Ward
**Assistant Professors:** Alice E. Crow, Carol J. Gryde
**Instructor:** Sheila Anderson
**Lecturer:** Marcia Madden
**Level I Fieldwork Coordinator:** Sheila Anderson
**Level II Fieldwork Coordinator:** Carol J. Gryde
**Medical Lecturers:** Luigi N. Dolcino, M.D., Richard Hockman, M.D., Kenneth Lee, M.D., Hilary Newland, M.D., Paul C. Young, M.D.

The following courses are for occupational therapy students; elective for others by permission of the course instructor.

**510. OCCUPATIONAL THERAPY—THEORY I**
Concepts and historical perspectives of the basic theories and techniques. Fundamentals of evaluation, testing, and problem solving; planning and administering treatment. Clinical observation and supervised clinical participation. Prereq: sophomore OT major. Lab. 4 cr.

**512. TREATMENT MEDIA ANALYSIS I**
Activity and its relationship to normal human development; teaching and supervising activities programs. Development of skills in treatment media and administration of activity programs. Minimum lab fee: $5. Prereq: OT major or permission. 2 cr.

**515. TREATMENT MEDIA ANALYSIS II**
Analysis of life tasks and human needs with an introduction to therapeutic analysis. Media explored for skill development and adaptation to treatment. Minimum laboratory fee: $12. Prereq: junior standing in OT major. Lab. 4 cr.

**531. GROUP PROCESS**
Dynamics and development of group relationships with emphasis on self-awareness and sensitivity to others. Comparison of normal and therapeutic groups. Group processes in practice; role development and leadership concepts. 2 cr.

**581. MEDICAL CONCEPTS FOR OCCUPATIONAL THERAPISTS**
Disease as a dynamic process affecting activity; medical and health models. Specific disease conditions addressed by a variety of health professionals. Prereq: junior standing in occupational therapy, or permission. 4 cr.

**582. OCCUPATIONAL THERAPY—THEORY II—REHABILITATION TECHNIQUES**
Techniques used by occupational therapists in rehabilitation of physically disabled clients; includes practice. Prereq: PhEd 652; OT 581; junior standing in major. 4 cr.

**583. OCCUPATIONAL THERAPY—PSYCHIATRIC FOUNDATIONS**
Clinical psychiatric conditions presented by a psychiatrist through patient interviews. Recognition of psychiatric symptoms, their cause, and general treatment are emphasized in follow-up sessions. Prereq: junior standing in OT major or permission. 4 cr.

**588. LEVEL I FIELDWORK—THREE ONE-WEEK FIELDWORK EXPERIENCES**
During sophomore, junior, and senior years, students are required to spend three weeks in a clinical setting during school breaks or summers. Written evaluation is required for each. Prereq: admission to OT program; permission. 1 cr. Cr/F.

**624-624L. OCCUPATIONAL THERAPY TREATMENT OF PSYCHOSOCIAL DYSFUNCTION**
Current frames of reference for occupational therapy practice in psychiatric/mental health settings. Focuses on client evaluation and treatment methods as well as an overview of program development approaches in mental health systems. Lab. Prereq: OT 531; OT 583. 4 cr.

**633. TREATMENT FOR PHYSICAL DISABILITIES**
Uses problem-solving model. Opportunity to acquire beginning skills in evaluation, setting of treatment goals, and selection of treatment techniques for clients with physical disabilities. Prereq: senior standing in major. 4 cr.

**634. LEVEL I—PHYSICAL DISABILITIES PRACTICUM**
Through the use of community based programs, the student will have the opportunity to plan and implement OT treatment programs for the client with a physical disability. Prereq: senior standing in the major. 4 cr.

**691. SENIOR PROJECT—DESIGN**
Design of independent study in occupational therapy. Choosing and defining a project topic. Exploration of literature and clinical/community resources; defining goals; contract with faculty adviser for approval and supervision. Prereq: senior standing in OT major. 1 cr. Cr/F.

**692. SENIOR PROJECT—IMPLEMENTATION**
Carrying out a Senior Project that was designed in OT 691; approved and supervised by a faculty adviser. Written report required. Prereq: OT 691. 1 cr.

**695. INDEPENDENT STUDY**
In-depth study with faculty supervision. Prereq: junior standing in OT major; approval of major adviser and faculty of area concerned. 2-4 cr.

**697. ORGANIZATION AND ADMINISTRATION**
Organization and administration of OT services. Practical problem-solving experiences. Development of fundamental research skills. Prereq: senior standing in major. 2 cr.

**698. SENIOR SEMINAR**
Current professional issues related to transition from the academic to the clinical fieldwork setting. Prereq: senior standing in major and permission. 1 cr. Cr/F.

**781. MEDICAL ASPECTS OF REHABILITATION**
Physicians present basic, practical medical knowledge and the effects of physical and mental illness on interpersonal relationships and work capacity. Major diseases and impairments which result in functional and vocational disability; medical terminology associated with them. Prereq: Educ 818 or equivalent; permission. 4 cr.

# Ocean Engineering

(See Special University Programs, page 95)

# Oceanography

(See Special University Programs, page 94)

# Philosophy (Phil)

**Chairperson:** Asher Moore

**Professors:** Donald C. Babcock, emeritus; Paul T. Brockelman, Asher Moore, Duane H. Whittier
**Associate Professor:** Robert C. Scharff
**Assistant Professors:** R. Valentine Dusek, Lynn M. Lindholm, Neil B. Lubow, Barbara Tovey, Yutaka Yamamoto
**Lecturer:** Judith M. St. Lawrence

**Introduction to Philosophy:** The 400-level courses (except 495) listed below are all introductions to philosophy; students should select among them according to interest.

**401. GENERAL INTRODUCTION TO PHILOSOPHY**
Depending upon the instructor, the emphasis will be on basic philosophic problems, recurrent types of philosophies, or selected readings from the history of philosophy. 4 cr.

**412. BEGINNING LOGIC**
Principles of good reasoning; the development of symbolic techniques for evaluating arguments. Not open to students who have had Math 420. 4 cr.

**416. PHILOSOPHICAL SURVEY OF WORLD RELIGIONS**
Fundamental literature and ideas of a number of the major religious traditions of mankind. For example, archaic religions, Hinduism, Buddhism, Taoism, Judaism, Christianity, Islam. 4 cr.

**417. PHILOSOPHICAL REFLECTIONS ON RELIGION**
Introductory philosophy of religion. To help students become critically aware of philosophical issues involved in various forms of religious belief and some of the persisting philosophical understandings of those issues. 4 cr.

**421. PHILOSOPHY AND THE ARTS**
Contemporary philosophic concerns and perspectives as reflected in one or more of the arts (literature, theater, film, music, plastic art). 4 cr.

**424. SCIENCE, TECHNOLOGY, AND SOCIETY**
Consideration of the scientific endeavor and its social import from a philosophical perspective. 4 cr.

**430. SOCIETY AND MORALS**
Critical study of principles and arguments advanced in discussion of current moral and social issues. Possible topics: violence, rules of warfare, sexual morality, human rights, punishment, abortion. 4 cr.

**435. THE HUMAN ANIMAL**
Philosophy of biology and the evolutionary process. Readings of scientists and philosophers' commentary on scientists. Examination of the differences between scientific debate and philosophic debate. Philosophical study of scientific theory stressing humans' place in the natural world and the ethical implication of humans as natural beings in the evolutionary process. 4 cr.

**475. PHILOSOPHICAL REFLECTIONS ON EDUCATION**
Philosophical study of the nature, significance, and place of education within the human condition. Students begin to work out and articulate their own attitudes toward the basic issues which lie at the heart of education at all levels. 4 cr.

**495. TUTORIAL READING**
Basic introductory reading under faculty direction on topics of philosophical importance. Books offered for tutorial reading may be in any area the instructor chooses or on an independent study basis. Prereq: permission. Variable to 4 cr.

**496. PHILOSOPHIC TOPICS**
Introductory-level seminar in specific topics or problems (e.g. death, love, friendship) considered from a philosophic point of view. 4 cr.

**520. INTRODUCTION TO EASTERN PHILOSOPHY**
Major Eastern traditions of philosophy. Concentration on Indian, Chinese, and Japanese systems may vary from semester to semester. 4 cr.

**530. MORAL PHILOSOPHY**
Critical examination of the development of philosophical thinking regarding human values, rights, and duties. 4 cr.

**550. SYMBOLIC LOGIC**
Principles and techniques of modern logic, with special attention to their philosophical significance. Sentential calculus, class calculus, truth tables, and lower functional calculus; nature of deductive systems, and problems of formal consistency. Prereq: Phil 412 or Math 420; /or permission. 4 cr.

**570. ANCIENT PHILOSOPHY**
Development of Western philosophy from its beginnings in Greece to the Roman period, with particular emphasis on the thought of Plato and Aristotle. 4 cr.

**571. MEDIEVAL PHILOSOPHY**
Philosophical thought of the Middle Ages from inception in the late Roman period with thinkers such as Plotinus and Augustine through the late Medieval speculative mysticism of such figures as Meister Eckhart. Writings of Augustine and Thomas Aquinas. 4 cr.

**575. MODERN PHILOSOPHY**
Philosophy of the 17th and 18th centuries, including both continental rationalism and British empiricism, and emphasizing philosophers selected from among such thinkers as Hobbes, Descartes, Spinoza, Leibniz, Locke, Berkeley, and Hume. 4 cr.

**577. 19th-CENTURY PHILOSOPHY**
Important 19th-century philosophical movements such as later German idealism, French positivism, utilitarianism, pragmatism, Marxism, existentialism, and vitalism. Prereq: Phil 575;/or permission. 4 cr.

**600. PHILOSOPHY THROUGH LITERATURE**
Philosophical implications of representative literary works; emphasis on recent and contemporary literature. 4 cr.

**610. TOPICS IN AMERICAN PHILOSOPHY**
Philosophical movements such as pragmatism and process philosophy. Readings from figures such as Peirce, James, Dewey, Santayana, Whitehead, and C.I. Lewis. Prereq: two courses in history of philosophy (one of which may be concurrent);/or permission. 4 cr.

**615. TOPICS IN ANALYTIC PHILOSOPHY**
The analytic methods applied to the solution of philosophic problems. Typical readings: Russell, Moore, Wittgenstein, Ayer, Ryle, and Austin. Prereq: two courses in history of philosophy (one of which may be concurrent);/or permission. 4 cr.

**620. RECENT EUROPEAN PHILOSOPHY**
Major developments and themes. Representative figures: Jaspers, Husserl, Heidegger, Bloch, Lukacs, Habermas, Bergson, Marcel, Sartre, Merleau-Ponty, Ricoeur, Kolakowski, etc. Prereq: two courses in history of philosophy (one of which may be concurrent);/or permission. 4 cr.

**630. PHILOSOPHY OF THE NATURAL SCIENCES**
Philosophical problems raised by the physical and biological sciences; role of mathematics in science, nature of scientific concepts of space and time, relations of science to common sense, relation of theory to observation, logic of scientific discovery, nature of historical changes in scientific world-view, relation of logic of science to the psychology and history of science. 4 cr.

**635. PHILOSOPHY OF LAW**
Systematic study of salient features of legal systems. Possible topics: nature of law; concept of legal validity; law and morality; individual liberty and the law; legal punishment; legal responsibility and related concepts (for example, legal cause, harm, *mens rea*, negligence, strict liability, legal insanity). 4 cr.

**640. KANT AND HEGEL**
Kant and Hegel. Prereq: two courses in history of philosophy;/or permission. 4 cr.

**Courses numbered 660 through 690 are designed to interest both specialists who wish to look at some of the broader implications of their work and students in general who have become aware that in today's world personal and social choices must often involve acquaintance with relevant scientific facts.**

**660. LAW, MEDICINE, AND MORALS**
Critical examination of the diverse legal and moral issues facing the profession of health care. Variable topics. Possible topics: duty to provide care; nature of informed consent to treatment; problems of allocating limited health care resources (e.g., withdrawal of life-support systems, quality-of-life decisions, etc.); patient's right to confidentiality; problems relating to involuntary preventive care (e.g. involuntary sterilization, psychosurgery, etc.) Staff: team-taught with a member of the School of Health Studies. 4 cr.

**675. COMPUTERS AND SOCIETY**
Philosophical and social implications of the "Computer Revolution." Five topical parts: historical development of the computer; automata and the concept of mind and man; computers and empirical science; the automation of management; prospects for future socio-cybernetic developments. Taught in cooperation with at least one expert in the field of computer science. 4 cr.

**683. TECHNOLOGY: PHILOSOPHICAL AND ETHICAL ISSUES**
The bases of modern technology in, and its impact upon, people's philosophic conceptions of themselves and their world. Ethical, social, political, and ecological implications of technology. Risk and benefit criteria. Technological and humanistic philosophies of life. 4 cr.

**690. INTERDISCIPLINARY STUDIES**
Interdisciplinary studies of philosophical issues arising in one or more areas of specialization outside the department and usually involving team-teaching. 4 cr.

**699. SENIOR THESIS**
Tutorial work for philosophy department candidates for "Commendation" and "Honors." Prereq: two courses in history of philosophy, senior standing, and permission. 4 cr. Cr/F.

**710. PHILOSOPHY OF RELIGION**
Philosophic nature and significance of religious experience; historical and systematic analysis of such traditional issues as the nature of faith, relation of faith to reason, arguments concerning the existence and nature of God, the problem of evil, the relationship of religion and morality, and the relationship of religion and science. Prereq: two courses in history of philosophy;/or permission. 4 cr.

**712. ADVANCED LOGIC**
A selection from: consistency and completeness of the predicate calculus; second-order logic; modal logic; axiomatic set theory; formalized arithmetic; recursive functions and Gödel's proof; Turing machines; formal semantics. Prereq: Phil 550; Math 531; /or permission. 4 cr.

**715. ETHICS**
Problems in ethical theory. Topics may include the utilitarian-deontologist dispute, analysis of moral language, problem of justification, and various conceptions of morality. Prereq: Phil 530;/or permission. 4 cr.

**720. PHILOSOPHICAL PSYCHOLOGY**
Philosophical perspectives and problems concerning human nature or the human condition; e.g. the nature of "self," human action, the body-mind problem, freedom of the will, the meaning of "person," the nature of behavior, etc. Prereq: two courses in history of philosophy;/or permission. 4 cr.

**725. PHILOSOPHY OF THE SOCIAL SCIENCES**
Nature of explanation and understanding in the social sciences. Similarities and differences between the social and physical sciences; claims of objectivity and of subjectivity in the social sciences; role of values in the social sciences. Prereq: two courses in history of philosophy;/or permission. 4 cr.

**735. SOCIAL AND POLITICAL PHILOSOPHY**
Important concepts in social and political philosophy such as natural rights, revolution, law, freedom, justice. Variable content. Prereq: two courses in history of philosophy or permission. 4 cr.

**740. AESTHETICS**
Philosophic inquiry into art and beauty. Prereq: two courses in history of philosophy;/or permission. 4 cr.

**745. PHILOSOPHY OF LANGUAGE**
Contemporary philosophical studies of the nature of meaning and structure of language. Prereq: two courses in history of philosophy;/or permission. 4 cr.

**750. PHILOSOPHY OF HISTORY**
Nature of historical knowledge, efforts to discover patterns of meaning in the past. Prereq: two courses in history of philosophy; /or permission. 4 cr.

**755. METAPHYSICS**
Advanced and detailed study of one or more important questions or schools of metaphysics; e.g. nature of being, nature of reality, relationship of thought and reality. Prereq: two courses in history of philosophy;/or permission. 4 cr.

**760. EPISTEMOLOGY**
Theory of knowledge; nature of knowledge and belief; nature of perception; theories of truth. Prereq: two courses in history of philosophy;/or permission. 4 cr.

**780. SPECIAL TOPICS IN PHILOSOPHY**
Advanced study of special topics; e.g., a problem, figure, or movement in the history of philosophy; or selected issues, thinkers, or developments in contemporary philosophy. Prereq: two courses in history of philosophy;/or permission. 4 cr.

**795, 796. INDEPENDENT STUDY**
For students who are adequately prepared to do independent, advanced philosophical work; extensive reading and writing. Before registering, student must formulate a project and secure the consent of a department member who will supervise the work. Conferences and/or written work as required by the supervisor. 1-4 cr.

# Physical Education (PhEd)

**Chairperson:** Phyllis A. Hoff

**Professors:** Marion C. Beckwith, Evelyn Browne
**Associate Professors:** Caroline S. Wooster; emerita; Katherine Amsden, Gavin H. Carter, Phyllis A. Hoff, Robert Kertzer, D. Allan Waterfield, Robert E. Wear, Walter E. Weiland
**Assistant Professors:** Thomas R. Barstow, D. Michael McKeough, B. Joyce Mills, Nancy C. Rupp
**Instructors:** Neal F. Earls, Elizabeth B. Payne
**Lecturer:** Frank C. Helies, Jr.
**Faculty from the Departments of Intercollegiate Athletics**
**Professor:** Paul C. Sweet, emeritus
**Assistant Professors:** Dwight E. Aultman III, Theodore W. Conner, Irvin T. Hess
**Lecturers:** M. William Bowes, John A. Copeland, Byron H. Davis, Cecelia DeMarco, Gerald J. Friel, Richard F. Garber, Jr., Leslie L. Henry, Jane E. Job, Carol E. R. Lowe, Jean M. Rilling, Jean E. Roberts

## The Major Program

Prospective physical education majors should refer to pages 81-83 for information regarding the major programs.

## The Elective Program

The Department of Physical Education provides an opportunity for students to participate in an elective activity program in a wide variety of sports, aquatics, conditioning, and gymnastics courses. Students may elect up to two credits of activity course work per semester. Courses offered include: aquatics (basic swimming, advanced lifesaving, water safety instructors' course, synchronized swimming, and SCUBA), archery, badminton, bicycling, bowling, figure control, figure skating, foil fencing, basic skating, golf, gymnastics, handball, hiking/orienteering, ice hockey, outdoor education, racquetball, skiing, ski conditioning, ski touring, squash, tennis, volleyball, weight training, yoga.

The department supplies special uniforms. Students are required to furnish such items as sneakers and bathing caps. A $35 fee is charged for SCUBA; fees are also charged for off-campus activities such as skiing. Students with physical limitations are encouraged to participate in the program on a modified basis. Students may repeat the same level activity for credit with the instructor's approval.

## Elective Physical Education

**410-455. ELECTIVE PHYSICAL EDUCATION**
Activity coursework open to all undergraduates. Cr/F.

### Half-Semester Courses (.5 credits each)

**410. ARCHERY**
**411. FIGURE SKATING—BEGINNING**
**412. FIGURE SKATING—ELEMENTARY/INTERMEDIATE**
**413. BICYCLING**
**414. BASIC SKATING**
**415. GOLF—BEGINNING**
**416. GOLF—INTERMEDIATE**
**417. ICE HOCKEY**
**418. SKI CONDITIONING**
**419. SKIING—BEGINNING***
**420. SKIING—BEGINNING†**
**421. SKIING—INTERMEDIATE†**
**422. SKIING—ADVANCED†**
**423. SKIING—RACING†**
**424. SKI TOURING—BEGINNING**
**425. TENNIS—BEGINNING**
**426. TENNIS—ELEMENTARY**
**427. TENNIS—INTERMEDIATE**
**428. TENNIS—ADVANCED**
**429. SPECIAL TOPIC**
**430. SPECIAL TOPIC**
**431. SQUASH**
**432. SKI TOURING—INTERMEDIATE**
**433. RACQUETBALL—BEGINNING**
**434. RACQUETBALL—INTERMEDIATE**
**436. BOWLING**
**443. OUTDOOR EDUCATION**

### Full-Semester Courses (1 credit each)

**435. BADMINTON**
**437. COURT GAMES (HANDBALL, RACQUETBALL, SQUASH)**
**438. FENCING—BEGINNING**
**439. FENCING—INTERMEDIATE**
**440. FIGURE CONTROL**
**441. GYMNASTICS**
**442. HIKING/ORIENTEERING**
**447. ADVANCED LIFESAVING**
**448. SWIMMING—BASIC**
**449. SYNCHRONIZED SWIMMING**
**451. VOLLEYBALL**
**452. WEIGHT TRAINING AND CONDITIONING**
**453. YOGA**
**454. SPECIAL TOPIC**
**455. SPECIAL TOPIC**

*On campus
†Gunstock

### Specialized Physical Education Coursework for Majors

**470-491. MAJOR ACTIVITY COURSEWORK**
Performance skills and beginning teaching methods.

**470. GYMNASTICS** 1 cr.
**471. OUTDOOR EDUCATION** 1 cr. Cr/F.
**472. EDUCATIONAL GYMNASTICS** 1 cr.
Gymnastics in movement education emphasizing the problem-solving method of teaching.

**473. TRACK & FIELD** 1 cr.
**474. FOLK, SQUARE, & SOCIAL DANCE** .5 cr.
**475. CONDITIONING** .5 cr.
**476. VOLLEYBALL** .5 cr.
**477. TENNIS** .5 cr.
**478. LEAD-UP GAMES** .5 cr.
**479. ACTIVITIES FOR ELEMENTARY SCHOOL** .5 cr.
**480. WRESTLING** .5 cr.
**481. MEN'S SOCCER** .5 cr.
**482. MEN'S LACROSSE** .5 cr.
**483. BASEBALL** .5 cr.
**484. SOFTBALL** .5 cr.
**485. MEN'S BASKETBALL** .5 cr.
**486. WOMEN'S LACROSSE** .5 cr.
**487. FIELD HOCKEY** .5 cr.
**488. FUNDAMENTALS OF MODERN DANCE** .5 cr.
**489. WOMEN'S SOCCER** .5 cr.
**491. WOMEN'S BASKETBALL** .5 cr.

## Theory Courses—Physical Education

**500. PERSPECTIVES IN PHYSICAL EDUCATION**
An introduction to the profession of physical education, including concentrations on the historical, sociological, and adapted perspectives. 4 cr.

**501. ADVANCED FIRST AID AND EMERGENCY CARE**
American National Red Cross program in advanced first aid and emergency care. 2 cr. Cr/F.

**502. BASIC ATHLETIC TRAINING**
Etiology, pathology, acute care, and prognosis of sports injuries. Lab. 4 cr.

**520. WATER SAFETY INSTRUCTORS' COURSE**
Analysis of aquatic techniques; methods of teaching swimming, diving, and lifesaving. A.R.C. instructor authorization awarded to candidates with high caliber of personal skill, knowledge, and teaching ability. Prereq: current advanced lifesaving certification. 2 cr.

**521. THEORY OF COACHING BASKETBALL**
Individual and team offense and defense; rules of the game. Problems in team handling and conditioning. Prereq: PhEd 485 or 491. 2 cr.

**522. THEORY OF COACHING FOOTBALL**
Systems of play; team and individual offensive and defensive fundamentals; theory and strategy of team play; coaching methods, physical conditioning; rules. 2 cr.

**523. THEORY OF COACHING HOCKEY**
Basic hockey skills. Fundamentals of individual and team offense and defense; coaching methods; rules. 2 cr.

**524. THEORY OF COACHING BASEBALL**
Batting and fielding; fundamentals of each position; problems of team play; coaching methods; physical conditioning; rules. Prereq: PhEd 483 or 484. 2 cr.

**525. THEORY OF COACHING SOCCER**
Fundamental and advanced skills and techniques; offensive and defensive principles of team play; tactical formations and strategy; methods of training and practicing; rules. Prereq: permission. 2 cr.

**526. THEORY OF COACHING WRESTLING**
Theory, practical teaching methods, and the development of advanced skills and techniques from basic maneuvers to the more advanced to develop ability to teach and coach wrestling. Prereq: PhEd 480. 2 cr.

**527. AQUATIC LEADERSHIP TRAINING**
Methods, organization, and administration of A.R.C. and YMCA aquatic programs. Methods of teaching swimming, diving, and lifesaving; program planning; officiating; operation and maintenance of swimming pools; camp waterfront; health and safety aspects of aquatic programs; legal problems; skin and SCUBA diving; drownproofing. Prereq: current advanced lifesaving certificate. 2 cr.

**528. THEORY OF COACHING TRACK AND FIELD**
Starting, sprinting, middle-distance and distance running, relay, hurdling, high and broad jumping, pole vault, shot putting, discus, hammer, and javelin. Methods of training and practicing. Prereq: PhEd 473. 2 cr.

**529. THEORY OF COACHING GYMNASTICS**
Theory, practical teaching methods, and officiating. Construction of gymnastic routines, from elementary to international level. Prereq: PhEd 470. 2 cr.

**530. THEORY OF COACHING SWIMMING AND DIVING**
Philosophy, historical development, and psychological theories of coaching. Mechanical and kinesiological aspects of the competitive strokes and required optional dives, low and high board. Prereq: PhEd 447. 2 cr.

**531. THEORY OF COACHING FIELD HOCKEY**
Analysis of field hockey coaching techniques. New systems of play; use of interval training for preseason conditioning and in-season practices. Prereq: PhEd 487 or permission. 2 cr.

**532. THEORY OF COACHING TENNIS**
Tennis fundamentals, technical play, and application of offensive and defensive strategies in the singles and doubles game. Coaching tactics and principles for special competitive situations. Prereq: PhEd 477 or permission. 2 cr.

**533. BASIC SCUBA**
Pool and classroom instruction in SCUBA fundamentals, N.A.U.I. certification for successful completion of course and 3 open water dives. Strong swimming ability required. $35 fee. 2 cr.

**534. ADVANCED SCUBA**
Pool, classroom, and open ocean experience in diving techniques and equipment used by underwater researchers. Prereq: basic certification and permission. $35 fee. 2 cr.

**563. THE THEORY OF TEACHING PHYSICAL EDUCATION IN THE SECONDARY SCHOOL**
Teaching methods. Lab. Prereq: minimum of 6 credits from coursework numbered PhEd 470–491; Educ 500. 4 cr.

**606. NEUROLOGY**
Morphology, physiology, and histology of the human nervous system. Designed primarily for students in occupational therapy. Lab. Prereq: Zool 507-508. 4 cr.

**610. ADAPTED PHYSICAL EDUCATION**
Common disorders of handicapped children; practical experience in the remediation of those disorders through the use of adapted physical education activities. Lab. Prereq: Zool 507-508. 4 cr.

**620. PHYSIOLOGY OF EXERCISE**
Acute and chronic effects of exercise. Respiration, circulation, and energy metabolism. Laboratory sessions demonstrate physiological adaptation to muscular activity. Prereq: Zool 507-508. 4 cr.

**621. EXERCISE LABORATORY TECHNIQUES**
Administration of graded exercise tests on treadmill, bicycle ergometer, and stepping bench. Monitoring physiological variables during the graded exercise test. Calculation of metabolic data resulting from the exercise test. Prereq: PhEd 620. 3 cr.

**622. THERAPEUTIC EXERCISE AND EXERCISE PRESCRIPTION**
Use of exercise test results to design, prescribe, and conduct exercise programs, primarily for adults. Lab. Prereq: PhEd 620. 3 cr.

**625. DYNAMICS OF HUMAN MOVEMENT**
Kinesiological consideration of factors which affect efficiency. Cinematographic and non-cinematographic forms of analysis of selected movement events and sequences. Prereq: Zool 507. (Not open to students who have taken PhEd 652). Lab. 4 cr.

**630. EVOLUTION OF SPORT**
Sports as an institution in selected geographical areas of the world. Relationship to war, art, and religion; ritualistic role; historic use by nations. Primarily for nonmajors. Prereq: permission. 4 cr.

**633. SOCIAL FOUNDATIONS OF SPORT AND PHYSICAL ACTIVITY**
Interdependence of human movement experiences, as exemplified in sport, play, and games, and various cultural, subcultural, and social factors. Prereq: Soc 400. 4 cr.

**635. SPORT IN LITERATURE**
Survey of sport as it is recorded in literature, both classical and contemporary, and the effect of sport on writing. 4 cr.

**637. SPORT—AN ETHOLOGICAL APPROACH**
Survey of ethology (animal behavior). Ethological principles applied to the development and conduct of sports and to other disciplines such as psychology, sociology. Prereq: Soc 411, or permission. 4 cr.

**650. EXERCISE SPECIALIST INTERNSHIP**
A six-month internship in an agency which offers physical activity programs of intervention and rehabilitation. Exercises include progressive exercise testing, exercise prescription, and exercise session leadership. Prereq: PhEd 622. 8 cr.

**652. KINESIOLOGY**
The science of human motion. Human muscular anatomy; actions of skeletal muscles using electromyographic evidence. Applications of concepts of muscle physiology and biomechanics to physical education activities. Lab. Prereq: Zool 507. (Not open to students who have taken PhEd 625.) 4 cr.

**668. MEASUREMENT PROCEDURES IN PHYSICAL EDUCATION**
Essential elementary statistical methods; measurement data scientifically evaluated for application to the program. Lab. 4 cr.

**675. MOTOR DEVELOPMENT OF THE YOUNG CHILD**
Characteristics of motor behavior across time, and the role of movement in a child's total development. Growth processes, analysis of movement, variations in movement due to maturation, environment, and experiences. Prereq: PhEd 472 or permission. Lab. 4 cr.

**692. THEORIES OF TEACHING PHYSICAL EDUCATION IN THE ELEMENTARY SCHOOL**
Current theories and methods; consideration given to growth and developmental needs in curriculum planning. Prereq: 6 credits from PhEd 470-491; Educ 500; PhEd 675. Lab. 4 cr.

**696. INDEPENDENT STUDY**
In-depth study. Prereq: PhEd majors with junior standing and approval of academic adviser and department chairperson. 2-4 cr.

**702. ADVANCED ATHLETIC TRAINING**
Assessment, rehabilitative treatment, preventive strapping and protective equipment used in athletic training. Administration of a training room facility. Lab. Prereq: PhEd 502. 4 cr.

**703. LABORATORY PRACTICE IN ATHLETIC TRAINING**
150 hours of experience in UNH athletic training room under N.A.T.A. certified trainer. Prereq: PhEd 502. May be repeated up to 8 cr. 2 cr.

**720. INTERPRETATION AND ASSESSMENT OF PHYSICAL FITNESS**
Planning and implementation of programs of conditioning and fitness in the general program of education in the school. Personal fitness; components of physical fitness and conditioning; current tests; rehabilitation of individuals of all ages, particularly in college and adult programs. Prereq: PhEd 620 or equivalent. 4 cr.

**730. CURRICULUM PLANNING IN PHYSICAL EDUCATION**
Criteria and factors involved in planning and construction of school programs. 4 cr.

**740. PERCEPTUAL MOTOR DYSFUNCTION**
Theoretical rationale and clinical perceptual-motor training programs of Ayres, Kephart, Cratty, Barsch, and Getman, as they relate to sensory-motor integration and the remediation of learning disabilities. Prereq: PhEd 775, or permission. 4 cr.

**750. ANALYZING TEACHING IN PHYSICAL EDUCATION**
Examination of teaching practices, theories, and research implications. Varied approaches to the study and improvement of teaching, including analysis of films and tapes. Prereq: PhEd 563 or 692 or permission. 4 cr.

**775. PERCEPTUAL MOTOR LEARNING**
Variables affecting the learning and performance of skilled activity; ability and motivational characteristics of the learner; processes for skill acquisition. Prereq: Psyc 401. Lab. 4 cr.

**780. PSYCHOLOGICAL FACTORS IN SPORT**
Factors of outstanding athletic achievement; psychological variables in competition; the actions and interactions of sport, spectator, and athlete. Prereq: Psyc 401;/or PhEd 775. 4 cr.

**791. HISTORY OF PHYSICAL EDUCATION**
From ancient Egypt to modern times. Influences of Greece, Rome, the Renaissance and Reformation periods, and modern European nationalism. Analysis of events and the beliefs of leaders in the development of systems of physical education. 4 cr.

# Physics (Phys)

**Chairperson:** Robert E. Houston, Jr.

**Professors:** Harry H. Hall, emeritus; Roger L. Arnoldy, L. Christian Balling, Edward L. Chupp, Robert E. Houston, Jr., Richard L. Kaufmann, Robert H. Lambert, John A. Lockwood, Lyman Mower, John E. Mulhern, Jr., William R. Webber
**Associate Professors:** John F. Dawson, Lennard A. Fisk, Jr., Jochen Heisenberg, Harvey K. Shepard, Robert E. Simpson, John J. Wright
**Assistant Professor:** Barry J. Harrington
**Lecturer:** L. William Dotchin

**401-402. INTRODUCTION TO PHYSICS I AND II**
Broad survey of classical and modern physics. Designed to enable students to appreciate the role of physics in today's society and technology. Emphasis on the fundamental laws of nature on which all science is based. Lab. 4 cr.

**403-404. INTRODUCTORY PHYSICS FOR BIOLOGISTS**
Physical principles of mechanics, thermodynamics, acoustics, optics, electricity, and modern physics, illustrated where possible with examples of interest to biologists. Knowledge of high school algebra and trigonometric functions essential. Lab. 4 cr.

**405. CONCEPTS OF PHYSICS**
Descriptive course investigating a limited number of important physical systems. Emphasis on how the system is to be investigated and the patterns in which the results fall. Intuitive concepts used in investigations traced into their application in modern physics. Patterns of thought in physics related to patterns of thought in liberal arts. Recommended for liberal arts juniors and seniors. 4 cr.

**406. INTRODUCTION TO MODERN ASTRONOMY**
Descriptive coverage of contemporary astronomical and astrophysical techniques with a review of current knowledge and theories concerning the solar system, galaxies, and the universe. Recommended for liberal arts and beginning science students. Lab. 4 cr.

**407-408. GENERAL PHYSICS I AND II**
Introductory course emphasizing mechanics and electromagnetism. Recommended for the serious student of science and engineering. Prereq: thorough knowledge of algebra and trigonometry; Math 425 for 407, and Math 426 for 408, or taken concurrently. Lab. 4 cr.

**411. HOUSEHOLD PHYSICS**
Practical, nonmathematical introduction to the physical principles necessary to understand how and why common devices work. Emphasis on household appliances and automobile. Classroom demonstrations and laboratories to illustrate theories and practical applications. Prereq: permission. Students may receive credit for either 411 or 412, but not both. 4 cr.

**412. TECHNICAL PHYSICS**
Applied course similar to Phys 411 but with more emphasis on industrial machinery and instruments. Recommended for Thompson School students. Prereq: algebra, trigonometry; permission. Students may receive credit for either 411 or 412, but not both. Lab. 4 cr.

**505. GENERAL PHYSICS III**
Wave motion, kinetic theory, heat, optics, introduction to relativity and quantum physics. Prereq: Phys 408; Math 425, 426. Lab. 4 cr.

**516. PHYSICAL MECHANICS**
Analytical treatment of classical mechanics covering dynamics of particles and rigid bodies. Newton's laws, conservation theorems, oscillations, central force problem, generalized coordinates, and Lagrange's equations. Prereq: Phys 505 or equivalent; Math 528 passed or taken concurrently. 4 cr.

**602. THERMAL PHYSICS**
Classical and statistical approach to thermodynamics, kinetic theory. Prereq: Phys 505; Phys 516 or equivalent; Math 528. 4 cr.

**605-606. EXPERIMENTAL PHYSICS I AND II**
Circuit design with passive and active elements, electrical measurements for experimental physics, digital electronics and interfacing techniques. Prereq: Phys 505; Math 527 passed or taken concurrently. Lab. 4 cr.

**607. PHYSICAL OPTICS**
Electromagnetic theory of light, interference, diffraction, polarization, related phenomena and nonlinear optics. Prereq: Math 528. Lab. 4 cr. (Offered if sufficient demand.)

**609-610. EXPERIMENTAL PHYSICS III AND IV**
Modern physics experiments and special project problems assigned to individual students. Prereq: senior standing in physics. Lab. 4 cr.

**613, 614. SPECIAL TOPICS I AND II**
Any selected topics not covered sufficiently in a general course may be studied. 4 cr.

**618. INTRODUCTION TO SOLID STATE PHYSICS**
Theory underlying the behavior of solids. Transport theory and the interaction of radiation and matter. Operation of semiconducting and superconducting devices and lasers. Prereq: Math 427 or equivalent. 4 cr. (Offered if sufficient demand.)

**695, 696. INDEPENDENT STUDY**
Individual project under direction of a faculty adviser. Prereq: departmental permission. 1-8 cr.

**701-702. INTRODUCTION TO QUANTUM MECHANICS I AND II**
Nonrelativistic Schroedinger equation, the hydrogen atom, applications to atomic and molecular structure; nuclear reactions and scattering; models of the nucleus; cosmic rays. Prereq: Math 527; Math 528; /or permission. 4 cr.

**703-704. ELECTRICITY AND MAGNETISM I AND II**
Foundation of electromagnetic theory; electrostatics, dielectric theory, electromagnetism, magnetic properties of matter, alternating currents, Maxwell's field theory, and an introduction to electrodynamics. Prereq: Math 527; Math 528; /or permission. 4 cr.

**710. INTRODUCTION TO MODERN COSMOLOGY**
Review of the sun, stars, Milky Way, external galaxies, and expansion of the universe. Recent discoveries of radio galaxies, quasi-stellar objects, cosmic black-body radiation, x-rays, and gamma rays precede a discussion of Newtonian and general relativistic cosmological models, steady-state/big-bang theories, and matter-antimatter models. Prereq: Phys 406; Phys 516; Math 527; /or permission. 4 cr.

# Plant Science (PISc)

**Acting Chairperson:** Owen M. Rogers

**Professors:** Russell Eggert, emeritus; Clarence A. Langer, emeritus; Ford S. Prince, emeritus; Gerald M. Dunn, Lincoln C. Peirce, Owen M. Rogers, Douglas G. Routley
**Associate Professors:** Henry A. Davis, emeritus; George O. Estes, Yun Tzu Kiang, David W. Koch, J. Brent Loy, James R. Mitchell, James E. Pollard, Jerry A. Warren, Otho S. Wells
**Adjunct Assistant Professor:** Merrill C. Hoyle

**421. CONCEPTS OF PLANT GROWTH**
Fundamentals underlying plant growth and response in natural and modified environments. Lab. 4 cr.

**427. LANDSCAPING THE HOME GROUNDS**
Design and maintenance of small properties; arrangement, plant use for the beautification of home surroundings. Lab. 4 cr.

**522. ENVIRONMENT AND PLANT RESPONSE**
Plant response to environmental factors; nature and control of environmental stresses; plants in the conservation and efficient use of environmental resources. Prereq: PISc 421 or Bot 411 or permission. Lab. 4 cr.

**535. HISTORY AND USE OF CULTIVATED PLANTS**
Importance of cultivated plants in various civilizations. Use of plant or plant-derived products in early and contemporary societies. Lab. 4 cr.

**566. TURF MANAGEMENT**
Adaptation and management of fine turf grasses for recreational, aesthetic, and functional use. 3 cr.

**604. PRINCIPLES OF GENETICS**
Chemical and physical bases of inheritance; genes and chromosomes as units of mutation; genes in populations. Prereq: Basic laboratory course in biological sciences. Organic chemistry; college math or statistics suggested. (Equivalent to Zool 604). 4 cr.

**606. PLANT PHYSIOLOGY**
Structure and function in higher plants; water relations, metabolism, and growth and development. Prereq: Bot 411, 503, or PISc 421; one year of chemistry;/or permission. Lab. (Equivalent to Bot 606.) 4 cr.

**607. WEED SCIENCE**
Biology and identification of common weeds; weeds in relation to humans; harmful effects of weeds; cultural, biological, and chemical control of weeds; properties and functions of herbicides; herbicides and the environment. Prereq: PISc 421. Lab. 4 cr. (Not offered every year.)

**651. FRUIT CROPS**
Tree fruits and small fruits of the temperate zone: culture, management, and marketing for the small enterprise. Lab. 4 cr.

**652. VEGETABLE CROPS**
A discussion of technology and systems for producing and marketing vegetables locally and nationally, and a study of characteristics of specific crops and of their response to environment. Prereq: PlSc 421 and 522 or equivalent. 4 cr.

**653. FORAGE CROPS**
Selection, establishment, and management of crops grown for livestock utilization; field-oriented lab. Prereq: PlSc 421, Bot 411, or permission. Lab. 4 cr.

**654. CEREAL CROPS**
Management practices related to the production and utilization of the world's major grain crops. Prereq: PlSc 421, Bot 411, or permission. 3 cr. (Not offered every year.)

**672. PLANT PROPAGATION AND MAINTENANCE**
Sexual and asexual propagation of horticultural plants. Plant Science majors only. Lab. 4 cr.

**678. ORNAMENTAL PLANTS**
Their identification, culture, and use. Prereq: Bot 566 or equivalent. Lab. 4 cr.

**705. POPULATION GENETICS**
Population growth and regulation; distribution of genes; factors affecting gene frequency; genetic load; natural selection; ecological genetics. Prereq: Zool or PlSc 604; INER 528; /or permission. 4 cr. (Not offered every year.)

**708. PLANT NUTRITION**
Nutritional aspects of higher plants; uptake, translocation, and metabolic role. Prereq: plant physiology; soils. Lab. 4 cr. (Not offered every year.)

**720. LABORATORY TECHNIQUES IN PLANT SCIENCES**
Use of laboratory instruments and techniques including extraction procedures, spectrophotometry, fluorometry, electrophoresis, chromatography, atomic absorption spectrophotometer, measurement of respiration and photosynthesis, photography, use of microscopes, and use of instruments for monitoring the environment. Prereq: chemistry (three semesters) or permission. 2 cr.

**732. PLANT DEVELOPMENTAL GENETICS**
Gene action in relation to development in plants; isozymes and differentiation, chromosomal proteins and gene regulation, temporal specificity of gene action, nuclear-cytoplasmic interactions, chemical gradients, and gene activation. Prereq: PlSc or Zool 604; PlSc 606; permission. Lab. 4 cr. (Not offered every year.)

**740. EVOLUTIONARY BIOLOGY**
Synthetic theory of evolution in origin of life, species, and higher groups; sources of genetic variability; population structure; causes of evolution; evolution of communities; molecular evolution and rates of evolution. Prereq: Zool or PlSc 604;/or permission. PlSc or Genetics 705 suggested. 4 cr. (Not offered every year.)

**762. PLANT METABOLISM**
Function, occurrence, synthesis and degradation of plant constituents; respiration and photosynthesis; metabolism of nitrogenous and aromatic compounds; biochemical mechanisms in seed dormancy, fruit ripening, and disease resistance. Prereq: Bchm 601 or 751. 2 or 4 cr. (Not offered every year.)

**773. METHODS AND THEORY OF PLANT BREEDING**
Plant breeding systems for qualitative and quantitative plant improvement. Prereq: PlSc or Zool 604; INER 528;/or permission. 3 cr. (Not offered every year.)

**776. RADIOISOTOPE TECHNIQUES FOR LIFE SCIENCES**
Application of radioisotopes to biological systems; detection and measurement, liquid scintillation spectrometry and autoradiography, gamma-ray spectrometry, radiochromatogram scanning, and tissue distribution of radioisotopes. Prereq: inorganic chemistry; physics. Lab. 4 cr.

**795, 796. ADVANCED TOPICS IN PLANT SCIENCE**
Independent research, study, or group discussion. A) Physiology; B) Genetics; C) Plant Utilization. Staff. Prereq: permission. 2 or 4 cr.

# Political Science (Polt)

**Chairperson:** Lawrence W. O'Connell

**Professors:** John T. Holden, emeritus; Robert B. Dishman, Bernard K. Gordon, George K. Romoser, Allan Spitz
**Associate Professors:** John R. Kayser, David L. Larson, David W. Moore, Lawrence W. O'Connell, B. Thomas Trout, Susan O. White, Frederic W. Wurzburg
**Assistant Professors:** Warren R. Brown, Robert E. Craig, Joseph P. Ford, George K. Lagassa

## Introductory Courses and Independent Study

**400. CONTEMPORARY POLITICS**
Examination of varying political issues, such as press censorship, electoral reform, international terrorism and security, governmental corruption, and environmental pollution. See departmental listings for semester offerings. 4 cr.

**401. POLITICS, MORALITY, AND COMMUNITY**
Nature of politics and political institutions as they relate to concerns of morality and community. Emphasis on political behavior and perennial issues of politics, such as power and authority, legitimacy, and freedom and order. 4 cr.

**402. AMERICAN POLITICS AND CULTURE**
Institutions and processes of national government in the United States, and political culture of the American people. Structure of national government; role of general public in government; literary, cultural, and ethical influences on American politics. 4 cr.

**403. THE UNITED STATES IN WORLD AFFAIRS**
Major issues in world affairs as they relate to United States foreign policy. U.S.-Soviet relations, third-world politics, regional and alliance politics, weapons technology and resource depletion, problems of economic development and population control. 4 cr.

**795, 796. INDEPENDENT STUDY**
For juniors and seniors with at least 3.0 cumulative G.P.A. Specialized programs of study. Application guidelines in department office. Prereq: permission. 4 cr.

## American Politics

**500. AMERICAN PUBLIC POLICY**
Political and economic factors which mold the processes by which American policymakers deal with such domestic issues as crime and violence, poverty and inequality, inflation and unemployment, urban blight and renewal, and energy and the environment. 4 cr.

**502. STATE GOVERNMENT AND FEDERALISM**
Powers, politics, and constitutional setting of American state governments. State legislature, governorships, party systems, and interest groups. Problems of taxation, welfare, environment, and education. 4 cr.

**503. LOCAL GOVERNMENT AND POLITICS**
Structure, politics, and legal setting of American local government, including towns, cities, counties, and special districts. Community power and decision making, town meetings and such issues as home rule, zoning, and the property tax. 4 cr.

**504. AMERICAN PRESIDENCY**
Role and powers of the presidency in domestic and foreign affairs. The president as administrator, policymaker, and political leader. Executive-congressional relations. 4 cr.

**505. AMERICAN CONGRESS**
Role and powers of Congress as national lawmaker and check on the executive branch. Committee structure, concepts of representation, legislative oversight, and party cleavage. Problems of federal budget control and foreign policy involvement. 4 cr.

**506. PARTIES, INTEREST GROUPS, AND VOTERS**
The role of political parties as organizers and managers of social conflict. The role of voters in controlling parties and government. The influence of interest groups in the electoral process and in governmental decision making. 4 cr.

**507. THE POLITICS OF CRIME AND JUSTICE**
Criminal justice in theory and practice; contemporary role of police, prosecutors, judges, juries, counsel, and interest groups in the administration of criminal justice. 4 cr.

**508. SUPREME COURT AND THE JUDICIAL PROCESS**
Supreme Court as a court of law and a political institution. The Court's role in interpreting both the powers of the government, in every branch and at every level, and the rights of the people under the Constitution. 4 cr.

**509. BUREAUCRACY IN AMERICA**
Growth and development of the bureaucratic state. Roles and powers of administrative officials, decision making in bureaucratic settings, citizen participation, and the influence of interest groups on bureaucratic policy making. 4 cr.

**600. SELECTED TOPICS IN AMERICAN POLITICS**
Special topics such as politics and public affairs in New Hampshire, the press and the media in America, women in politics, and civil liberties. See department listings for semester offerings. 4 cr.

**601. ELECTION PRACTICUM**
Field work in political campaigns combined with analysis of the electoral process. Prereq: permission. 4 cr. (Not offered every year.)

**602. INTERNSHIP IN AMERICAN GOVERNMENT**
Practical work experience in a federal, state, local, or regional government office will be integrated with assigned readings and a student research project. Prereq: permission. 4 cr.

**701. THE COURTS AND PUBLIC POLICY**
Impact of judicial decisions on public policy at federal, state, local, and regional levels. 4 cr.

**702. PUBLIC PLANNING AND BUDGETING**
Analysis, goal setting, and strategic planning in a governmental setting, with particular emphasis on budgetary processes as a means for controlling policy effectiveness. 4 cr.

**703. URBAN AND METROPOLITAN POLITICS**
Planning and management of the urban community, intergovernment relations, administrative functions, and general urban problems. 4 cr.

**797, 798. SECTION B: SEMINAR IN AMERICAN POLITICS**
Advanced analysis and individual research. Prereq: senior or graduate standing. 4 cr.

**797, 798. SECTION F: SEMINAR IN PUBLIC ADMINISTRATION**
Advanced analysis and individual research, including opportunities for direct observation of governmental administration. Prereq: senior or graduate standing. 4 cr.

## Comparative Politics

**544. DICTATORSHIP AND TOTALITARIANISM**
Political systems of Nazi Germany, Fascist Italy, Stalinist Russia, and Maoist China; the movements which gave rise to them and their significance for understanding political behavior. 4 cr.

**552. CONTEMPORARY EUROPEAN POLITICS**
Politics and governments in Western Europe, with attention both to basic characteristics of political life in different countries and current issues of politics. 4 cr.

**553. DEVELOPING NATIONS**
Politics in selected developing states in Africa, Latin America, Asia, and the Middle East. Issues and concepts of political change. 4 cr.

**555. POLITICS IN THE USSR**
Background, structure, leadership, and underlying issues of the Soviet political system. Ideological bases, political history, and contemporary trends. 4 cr.

**556. POLITICS IN CHINA**
Historical development, structure, ideological bases, and underlying contemporary issues of the Chinese political system; influence of ideology and the role of Maoism. 4 cr.

**557. POLITICS IN JAPAN AND SOUTHEAST ASIA**
Major noncommunist governments in East Asia; parties and policy-making in Japan and other states such as Malaysia, Thailand, Indonesia, and the Philippines. 4 cr.

**651. SELECTED TOPICS IN COMPARATIVE POLITICS**
Specialized areas or issues such as territory in politics, politics of Germany, judicial systems, administrative law, etc. See department listing for semester offerings. 4 cr.

**741. POLITICS OF INDUSTRIALIZED STATES**
Impact of modern industrialism and its organization upon political life and the conduct of government. 4 cr.

**742. COMMUNIST SYSTEMS**
Interests, demands, and decision making in communist governments. Ideological issues, political behavior within communist international organizations, intraparty relations, distinctions between ruling and nonruling communist parties. 4 cr.

**797, 798. SECTION C: SEMINAR IN COMPARATIVE POLITICS OF NATIONS**
Includes advanced analysis and individual research on national or regional politics. Prereq: senior or graduate standing. 4 cr.

**797, 798. SECTION D: SEMINAR IN COMPARATIVE POLITICS**
Includes advanced analysis and individual research. Administration, foreign policy, political parties, and governmental institutions. Prereq: senior or graduate standing. 4 cr. (Not offered every year.)

## International Politics

**560. WORLD POLITICS**
Issues and structures which shape contemporary international politics, including rise of the nation-state system, conflict and its resolution, and problems of national interest and choice between nations. 4 cr.

**561. AMERICAN FOREIGN POLICY**
Processes, institutions, and economic factors which influence American policies toward foreign nations. 4 cr.

**562. STRATEGY AND NATIONAL SECURITY POLICY**
Defense and deterrence among the major powers, including the impact of modern weapons on war and arms limitations, the military as a profession and the role of the armed forces in shaping defense policy. 4 cr.

**563. FOREIGN POLICIES OF EUROPE**
East-West relations, security alliances, economics and political cooperation, and impact of domestic changes and superpower relationships upon the international politics of Europe. 4 cr.

**564. SOVIET FOREIGN POLICY**
Background and contemporary perspectives of the Soviet role in international politics. Particular emphasis on issues in international communism, Soviet-American relations, Soviet arms development and Sino-Soviet relations. 4 cr.

**565. FOREIGN POLICIES OF ASIA AND THE PACIFIC**
Current foreign and defense policies as they affect the Pacific region. International politics of China, Japan, and selected Southeast Asian nations, including their efforts at cooperation. 4 cr.

**660. SELECTED TOPICS IN INTERNATIONAL POLITICS**
Specialized areas or issues in international relations: conflict resolution and disarmament, European perspectives on American politics, contemporary diplomatic practices, seapower and defense, etc. See department listings for semester offerings. 4 cr.

**760. THEORIES OF INTERNATIONAL POLITICS AND INTEGRATION**
General explanations of the behavior of nations; theory and practice of super-national integration; theories of peace and security and community building at the international level; concepts and experience in arms limitations and conflict resolution. 4 cr.

**761. INTERNATIONAL LAW**
Formalized processes for regularizing state behavior; development of norms based on custom, precedent, and formal institutions, as in treaties and cases. Arms reduction and limitation arrangements; inspection, and other formal procedures designed to preserve peace. 4 cr.

**778. INTERNATIONAL ORGANIZATION**
Collective security and other forms of cooperation among nations through international organizations such as the United Nations and its predecessors, and through regional bodies. 4 cr.

**797, 798. SECTION E: SEMINAR IN INTERNATIONAL POLITICS**
Advanced analysis and individual research; emphasis on developments in theory. Prereq: senior or graduate standing. 4 cr.

## Political Thought

**520. JUSTICE AND THE POLITICAL COMMUNITY**
Origin of the idea of justice; relationship between politics, justice, and morality; selections from Plato, Aristotle, and Roman, Islamic, and Christian political philosophers. 4 cr.

**521. RIGHTS AND THE POLITICAL COMMUNITY**
Human rights and the quality of communities as expressed in Hobbes, Locke, Mandeville, Rousseau, and others. 4 cr.

**522. DISSENT AND THE POLITICAL COMMUNITY**
Current political ideologies and controversies in America and abroad; liberal democracy and its critics since the 19th century. 4 cr.

**523. AMERICAN POLITICAL THOUGHT**
American political thinkers and observers of American politics; the founding of the Republic; problems and tensions reflected in the writings of Calhoun, Thoreau, Lincoln, de Tocqueville, and others; relations between liberty and authority, democracy and stability, capitalism and alienation. 4 cr.

**524. POLITICS AND LITERATURE**
Classical and contemporary works of literature to illustrate perennial issues in political philosophy; among authors studied are Aristophanes, Sophocles, Shakespeare, Melville, Tolstoy, and Sartre. 4 cr.

**620. SELECTED TOPICS IN POLITICAL THOUGHT**
Selected issues in political theory: liberalism and conservatism, radical political thought, the American political character, and others. See department listings for semester offerings. 4 cr.

**720. PERSPECTIVES ON POLITICAL SCIENCE**
Different views on the study and meaning of politics. Perspectives of political scientists, political philosophers, and political activists. 4 cr.

**721. ECONOMIC THOUGHT AND POLITICS**
Economic theories from the perspective of political thought. Economic activity and resource distribution in relation to historical and contemporary issues such as freedom, equality, authority, community, democracy, and quality of life. 4 cr.

**797, 798. SECTION I: SEMINAR IN POLITICAL THOUGHT**
Advanced treatment and individual research. Prereq: senior or graduate standing. 4 cr.

# Portuguese

(See Ancient and Modern Languages and Literatures: Spanish)

# Psychology (Psyc)

**Chairperson:** Ronald E. Shor

**Professors:** Herbert A. Carroll, emeritus; George M. Haslerud, emeritus; Robert I. Watson, emeritus; Raymond L. Erickson, Eugene S. Mills, John A. Nevin, Ronald E. Shor
**Associate Professors:** Lance K. Canon, James R. Davis, Peter S. Fernald, Earl C. Hagstrom, John E. Limber, Stephen J. Weber, Daniel C. Williams
**Adjunct Associate Professor:** Robert G. Congdon
**Assistant Professors:** William M. Baum, Ellen S. Cohn, R. Michael Latta, David E. Leary, David I. Schickendanz, Marty J. Schmidt, William R. Woodward
**Lecturers:** Elaine Reid, Stephen Seeman, Robert Smith, Sally Stram, Dan Swift

The listings below are general descriptions of the courses. Students are referred to the Instructors' Course Descriptions published by the department each semester for specific details about each section. Listings will be made available in departmental offices and through all psychology faculty before and during the preregistration period. All courses are offered each year unless otherwise noted. All general courses and basic major courses are offered every semester.

## General Courses

**401. INTRODUCTION TO PSYCHOLOGY**
Psychology as a behavioral science; its theoretical and applied aspects. Prerequisite for all other courses in the department. To actively experience the nature of psychological research, students are expected to meet a laboratory experience requirement. 4 cr.

**471. THE GREAT PSYCHOLOGISTS**
Historical introduction to some of the great psychologists and their classic works. 4 cr.

**511. INTRODUCTION TO PERCEPTION, LANGUAGE, AND THOUGHT**
Human mental processes. Visual and auditory perception; language and communication; thinking; problem solving; and creativity. Interrelationships among these areas of human psychology. Prereq: Psyc 401. 4 cr.

**521. PRINCIPLES OF LEARNING AND THEIR APPLICATION**
Principles developed from experimental study of human and animal learning; their theoretical integration; their application to the understanding of human behavior. Procedures for changing behavior in practical situations, related to theories of learning. Prereq: Psyc 401. 4 cr.

**531. PSYCHOBIOLOGY**
The human as a biological machine; advantages and limits of such an approach for studying behavior. Perception, language, and thought; learning and memory; emotions from the point of view of physiology. These behaviors in terms of what occurs in the organism. Prereq: Psyc 401. 4 cr.

**561. CLINICAL APPROACHES TO HUMAN BEHAVIOR**
Normal and abnormal behavior from the viewpoints of Freud, Rogers, learning theorists, existentialists, and others. Human behavior; clinical procedures of evaluating and modifying behavior. Nature of the clinical approach; no clinical training. Prereq: Psyc 401. 4 cr.

**581. THE STUDY OF CHILD BEHAVIOR**
The developing child in context of his/her society. Current problems in and influences on development of the child. Personality and cognitive development; and exceptional children. Prereq: Psyc 401. 4 cr.

**671. HISTORY OF PSYCHOLOGY**
Survey of the history of psychology up to the 20th century. Major figures, theories, and developments. Relationship to developments in cultural history, philosophy, and the natural sciences. Beginnings of modern scientific psychology. 4 cr.

## Major Courses

**601. STATISTICS AND METHODOLOGY IN PSYCHOLOGY**
Design, procedure, statistical analysis, and decision making in psychological research. Substantive problems as illustrations of typical applications and underlying logic. Prereq: Psyc 401. Required of all undergraduate majors. 4 cr.

**602. EXPERIMENTAL PSYCHOLOGY**
Experimental methods applied to psychological phenomena; principles of experimental design; methods of data analysis. Each student responsible for an original experiment. Prereq: Psyc 601. 5 cr.

**621. LEARNING AND MOTIVATION**
Learning and motivation related to contemporary theories of behavior integrated with other areas of psychology. Theory, research methods, and applications. Major concepts and recent research. Prereq: Psyc 401. 4 cr.

**651. PSYCHOLOGY OF PERSONALITY**
Major theories; acquisition, maintenance, and modification of individual behavior. Research and the nature of theorizing. Prereq: Psyc 401. 4 cr.

**652. SOCIAL PSYCHOLOGY**
Behavior of individuals as affected by other individuals, groups, and society. Topics include attitude change and social influence, conformity, social interaction, interpersonal attraction, impression formation, research. Prereq: Psyc 401. 4 cr.

**702. ADVANCED STATISTICS AND RESEARCH METHODOLOGY**
Experimental design, analysis, and interpretation. Repeated measures, designs, trend analyses, nonparametric analyses, confounding, missing data, interpretation of interactions, and computer processing of data. Intended primarily for majors planning to attend graduate school. Prereq: Psyc 601 and one 700-level Psyc course. 4 cr. (Not offered every year.)

**704. RESEARCH METHODS IN SOCIAL PSYCHOLOGY**
Features, assets, liabilities, and appropriate applications of measurement, survey methods, field and laboratory experiments, and nonreactive methods. Philosophy of science, ethical responsibility, and artifact in research. Each student responsible for an original research project. Prereq: Psyc 601; 652. 4 cr.

**705. TESTS AND MEASUREMENT**
Testing intelligence, creativity, achievement, interests, and personality. Test construction; evaluation; relation to psychological theory, research, and practice. Prereq: Psyc 601. 4 cr.

**711. SENSATION AND PERCEPTION**
Sensory systems in processing information and experiencing objects and events. Global theories of perception and specific perceptual processes. Stimulus definition, scaling, perceptual development, social perception, selective attention, pattern vision, color vision, auditory localization, signal detection, and sensory deprivation. Prereq: Psyc 601. 4 cr.

**712. PSYCHOLOGY OF LANGUAGE**
Theories of language structure; functions of human language; meaning; relationship of language to other mental processes; language acquisition; indices of language development; speech perception; reading. Prereq: Psyc 601;/or permission. 4 cr.

**713. COGNITION**
Complex mental activities; consciousness and attention; concept formation; reasoning; problem solving; creative thinking; relationship between cognition and affective behavior. Prereq: Psyc 601. 4 cr.

**722. HUMAN LEARNING**
Experimental study of human learning and retention. Memory, transfer, verbal learning, perceptual learning, concept learning, and observational learning. Methodologies typical of research in these areas. Prereq: Psyc 601; 602 or 621. 4 cr.

**723. APPLIED BEHAVIORAL ANALYSIS**
Applications of learning theory to the solution of socially relevant problems. Appreciation of current research and theory in the field of applied behavior analysis. Prereq: Psyc 602 or 621. 4 cr.

**731. BRAIN AND BEHAVIOR**
Relationships between the nervous system and behavior. Physiological, neural, and biochemical mechanisms underlying instinct, memory, learning, emotion, and consciousness in humans; evolution of these functions in lower animals. Prereq: Psyc 601. 4 cr.

**732. COMPARATIVE PSYCHOLOGY**
Methodologies; comparisons of the basic processes of sensation, motivations, learning, and social behavior in different species. Contemporary theories of behavior formulated by ethologists contrasted and compared with current theories in psychology. Prereq: Psyc 601. 4 cr.

**754. ATTITUDES AND SOCIAL INFLUENCE**
Theories, nature, and measurement of attitude; research and theory on conformity and leadership examined as problems in interpersonal influence. Recent psychological literature. Prereq: Psyc 601; 652. 4 cr.

**755. SOCIAL PSYCHOLOGY OF SOCIAL ISSUES**
Prejudice, group conflict, overpopulation, war, and ecological problems. Specific social psychological processes applied to the nature and solution of each problem. Prereq: Psyc 601; 652. 4 cr.

**756. ENVIRONMENTAL PSYCHOLOGY**
Human behavior as influenced by the physical environment. Research and theory on such topics as privacy, territoriality, crowding, personal space, urban stress, behaviorally-based design, paralinguistics, and behavior in natural settings. Prereq: Psyc 601; 652. 4 cr.

**757. POLITICAL PSYCHOLOGY—VOTING BEHAVIOR**
Emphasis on the New Hampshire preferential primary. Contrasting analyses of voter decision making; relationship between public opinion and choice behavior; students collect and analyze data from the primary; development and practice of appropriate research skills. Prereq: Psyc 601; 652. 4 cr. (Not offered every year.)

**761. ABNORMAL PSYCHOLOGY**
Disturbing behaviors; historical developments; viewpoints of etiology; identifying and understanding disruptive behavior; diagnostic implications for treatment as a function of varying theoretical viewpoints. Prereq: Psyc 601. 4 cr.

**762. COUNSELING**
Parameters of problems in daily living; analysis of individual, group, and institutional therapeutic interventions. Therapeutic process and outcome; ethical considerations; professional and paraprofessional activities in a variety of work settings. Prereq: Psyc 601. 4 cr.

**771. SURVEY OF 20th CENTURY PSYCHOLOGY**
Reassesses, extends, and integrates knowledge of 20th century psychology within historical perspective. Major figures, schools, systems, theories. Review of major fields of psychology. Useful as preparation for the Graduate Record Examination. Prereq: Psyc 601. 4 cr.

**781. DEVELOPMENTAL PSYCHOLOGY**
Current research and major theories; cognitive, personality, learning, and emotional development. Prereq: Psyc 601; 581 or HEc 525. 4 cr.

## Special Courses

**591. SPECIAL TOPICS**
New or specialized courses are presented under this listing. Staff present material not normally covered in regular course offerings. May repeat but not duplicate areas. Descriptions of courses on file in the psychology offices during registration. Prereq: Psyc 401. 4 cr.

**791. ADVANCED TOPICS**
Advanced material in which instructor has specialized knowledge through research and study. May repeat, but not duplicate areas. Course descriptions on file in the psychology offices during registration. Prereq: Psyc 601; 16 credits of psychology;/or permission. 4 cr.

**793. EXTERNSHIP**
Supervised practicum in one of several cooperating New Hampshire mental health/rehabilitation facilities. Coursework knowledge applied to meaningful work and team experience. Commitment includes a negotiated number of weekly work hours and weekly seminars. Supervision by institutional personnel and the instructor. Student continuation in the course throughout the semester dependent on favorable periodic performance assessment. Course applications accepted in March for fall term and October for spring term. Prereq: permission; Psyc major; Psyc 601; additional psychology courses desirable. A maximum of 4 credits count toward major. 4-8 cr.

**794. ADVANCED EXTERNSHIP**
Supervised advanced practicum experience in cooperating New Hampshire mental health/rehabilitation facilities. Expands and builds on experiences and skills acquired in Psyc 793 in a way not possible in the classroom. Commitment includes a negotiated number of hours of work per week and participation in weekly seminars. Supervision done by institution personnel and instructor. Course applications accepted beginning in April for fall term and November for spring term. Prereq: Psyc 793; permission. Maximum of four credits can count toward the minimum of 32 credits for Psyc major. 4-8 cr.

**795. INDEPENDENT STUDY**
A) Physiological; B) Perception; C) History and Theory; D) Learning; E) Social; F) Cognition; G) Statistics and Methods; H) Experimental; I) Personality; J) Developmental; K) Counseling; L) Psychotherapy; M) Research Apprenticeship; N) Teaching of Psychology (content area to be determined). Arrangements to be made with a specific faculty member; enrollment by permission only. 1-4 cr.

# Recreation and Parks (RecP)

**Chairperson:** Gus C. Zaso

**Associate Professor:** Gus C. Zaso
**Assistant Professors:** Robert D. Greenleaf, Lawrence A. Rondeau
**Adjunct Assistant Professor:** Wilbur F. LaPage

**400. IMPACT OF LEISURE**
Issues which contribute to the emergence of a leisure-oriented society and significant problems which accompany the expansion of leisure opportunities. 4 cr.

**454. SPECIAL FACILITY OPERATIONS**
Management of public, private, and commercial campgrounds. 4 cr.

**455. INTRODUCTION TO RECREATION AND PARK SERVICES**
Role of recreation and parks in contemporary society. 4 cr.

**457. DYNAMICS OF LEADERSHIP AND PROGRAMMING**
Leadership processes and their relationship to principles of program planning and evaluation. 4 cr.

**543. COMPARATIVE ENVIRONMENTAL EDUCATION**
Interdependent environmental analyses with application to recreation and education situations. 4 cr.

**544. OUTDOORS EDUCATION**
Elements of programming as they relate to the school curriculum and school camping. 4 cr.

**560. CAMPUS RECREATION SERVICES**
Management of college unions and campus recreation resources in higher education. 4 cr.

**564. FIELD WORK**
Supervised experience in approved recreation and park agencies. Prereq: RecP major. 4-8 cr. Cr/F.

**661. RECREATION RESOURCES MANAGEMENT**
Park practices as they relate to location, management, and maintenance. 4 cr.

**663. RECREATION AND PARK ADMINISTRATION**
Theoretical and practical methods used in attaining organizational goals. 4 cr.

**664. SAFETY AND SECURITY OPERATIONS**
Accident prevention and security procedures as applicable to recreation and park systems. 4 cr.

**667. RECREATION AND RESOURCE PLANNING**
Master planning concepts which relate to public systems. 4 cr.

**668. DESIGNING AND ENGINEERING**
Practices involved in constructing indoor and outdoor recreation facilities. 4 cr.

**771. LEGAL ASPECTS**
Basic legal aspects of leisure-oriented services. 4 cr.

**772. FINANCIAL ADMINISTRATION**
Business procedures which relate to municipal finance and budgeting techniques. 4 cr.

**796. INDEPENDENT STUDY**
Individual study and/or research relating to leisure-oriented topics. 1-4 cr.

**798. SEMINAR IN LEISURE**
Reviews of problems, trends, and current practices. 4 cr.

## Reserve Officers Training Corps

(See Aerospace Studies and Military Science)

## Resource Economics

(See Institute of Natural and Environmental Resources)

## Russian

(See Ancient and Modern Languages and Literatures)

## School of Health Studies (SHS)

**400. HEALTH-HUMAN VALUES**
Physiological, emotional, social, and environmental factors affecting health. Basic health information to broaden understanding of health-related issues. Students examine their patterns of decision making in issues directly affecting their lives. 4 cr.

**798. SPECIAL TOPICS IN HEALTH STUDIES**
Students may explore areas related to specific professional health interests. May repeat but not duplicate subject areas. A) Communication Disorders; B) Health Studies; C) Medical Technology; D) Nursing; E) Occupational Therapy; F) Physical Education; G) Recreation and Parks; K) Survey of Therapeutic Approaches to Developmental Disabilities (interdisciplinary); H-J and L-Z) Interdisciplinary. Prereq: permission. 1-4 cr.

## Secretarial Studies (Secr)

**Associate Professors:** Doris E. Tyrrell, emerita; Myra L. Davis

**401-402. SHORTHAND**
Principles of Gregg shorthand followed by dictation and transcription. Prereq: proficiency in typing or Secr 405 or 407 taken concurrently. 4 cr.

**405. PERSONAL USE TYPEWRITING**
Practice in acquiring correct typewriting techniques, and in arranging letters and manuscripts. Open to students who do not know how to type. 2 cr. Cr/F.

**407-408. TYPEWRITING**
Beginning course, primarily for students interested in two semesters. 2 cr.

**427. TYPEWRITING**
To be taken instead of Secr 407 by students who have had a personal-use typewriting course. Class begins at midsemester. 1 cr.

## Social Science (ScSc)

Courses coordinated by the chairperson of the Social Science Division, College of Liberal Arts.

**681. INTERNSHIPS**
Fieldwork in a state or local government department, agency, or institution, or in an approved private agency. Work will be under supervision of agency. Department chairperson or representative is responsible for arranging the program. Offered through Departments of History, Political Science, Psychology, Sociology, and Anthropology, or the Whittemore School of Business and Economics. Prereq: senior standing. Variable to 16 cr.

## Social Service (S S)

**Chairperson:** Pauline Soukaris

**Associate Professor:** Pauline Soukaris
**Assistant Professors:** Richard J. Kaufman, Betty Holroyd Roberts
**Instructor:** Wilma Valenzuela

**522. INTRODUCTION TO SOCIAL WELFARE POLICY: PROVISIONS**
U.S. social welfare provisions: income, housing, employment, and health care. Program and policies in historical perspective: their auspices, goals, and operations for consumers from various social, racial, and ethnic groups. 4 cr.

**523. INTRODUCTION TO SOCIAL WELFARE POLICY: SERVICES**
Child and family, elderly, school, correctional, medical, and mental health. Programs, policies, and services in historical perspective: their auspices, goals, and operations for consumers for various racial, ethnic, and social groups. Weekly observational/participatory assignments at community agencies. Prereq: S S 522;/or permission. 4 cr.

**622. SOCIAL WORK PRACTICE I**
Introduction to methods and practice. Basic principles, values, and ethics. Interviewing skills, problem assessment, social contracting. Skills training in lab sessions. Required for majors, should be taken in junior year. Prereq: S S 523 or permission. 4 cr.

**623. SOCIAL WORK PRACTICE II**
Continuation of S S 622. Delineation and study of intervention and change strategies differentiated with individuals, groups, and communities. Required for majors. Prereq: S S 622. 4 cr.

**631. SOCIAL WELFARE FIELD EXPERIENCE**
Majors will be placed in a social welfare setting for a minimum of 300 hours, concurrent with a weekly seminar on campus; individual arrangements with faculty coordinator. Required for majors. Prereq: S S 623 and permission. (No credit toward a minor.) 12 cr. Cr/F.

**632. SPECIAL TOPICS IN SOCIAL WELFARE**
Seminar for advanced majors. Topics may include income maintenance, alcoholism, health care, aging, child welfare, and mental health; to increase understanding of factors that influence program development and service delivery. Prereq: S S 631 or permission. 4 cr.

**633. SEMINAR IN SOCIAL WORK METHODS**
Analysis and comparison of change theories, intervention strategies, therapeutic techniques. Seminar format. Possible topics: techniques of group work, casework or community practice, behavior modification, and staff development and supervision. Prereq: senior major standing. 4 cr.

**700. SOCIAL GERONTOLOGY**
Theories, social problems, programmatic responses, and recent research on aging; emphasis on the psycho-social forces. Prereq: senior or graduate status;/or permission. 4 cr.

**701. WOMEN AND AGING**
An analysis of the major theories about the social conditioning of aging women and its effect in contemporary society. Human service response will be addressed. Psycho-social, biological, legal, and economic implications will be reviewed. Prereq: senior or graduate status or permission. 4 cr.

**711. NEW TRENDS IN HUMAN SERVICE DELIVERY**
Systematic examination of changing service delivery patterns/systems in the human services; obstacles/roadblocks to improved service delivery; analysis of specific programs, approaches, services, and issues in the field. Prereq: senior or graduate status or permission. 4 cr.

**795, 796. READINGS AND RESEARCH IN SOCIAL SERVICE**
Independent work under social service faculty guidance. Prereq: 12 hours of social service; permission. Variable 2, 4, or 6 cr. Cr/F.

# Sociology and Anthropology

**Chairperson:** Richard E. Downs

**Professors:** Melvin T. Bobick, Walter F. Buckley, Bud B. Khleif, Arnold S. Linsky, Stuart H. Palmer, Solomon Poll, Murray A. Straus
**Associate Professors:** Charles E. Bolian, Peter Dodge, Richard E. Downs, Melville Nielson, Stephen P. Reyna, Frederick Samuels, Howard M. Shapiro
**Assistant Professor:** Barbara K. Larson
**Assistant Professor (Part-Time) and Archaeologist:** Gary W. Hume
**Lecturer:** Howard Hecker
**Instructor:** Deborah Winslow

## Anthropology (Anth)

**411. CULTURAL AND SOCIAL ANTHROPOLOGY**
Cultural and social aspects of human behavior, particularly in relation to nonindustrial societies. Analysis of selected societies, institutions, and forms of social structure. 4 cr.

**412. PHYSICAL ANTHROPOLOGY AND PREHISTORIC ARCHAEOLOGY**
Human physical evolution and cultural prehistory; evolutionary theory and archaeological techniques. 4 cr.

**512. INTRODUCTION TO WORLD ETHNOGRAPHY**
Primarily for majors and minors, but open to all students. Historical and geographic factors, types of social and economic organization, and problems involved in the comparative study of human societies and institutions. Analysis of selected peoples in the major ethnographic areas. Prereq: Anth 411 or equivalent; /or permission. 4 cr.

**514. METHOD AND THEORY IN ARCHAEOLOGY**
Basic method and theory; techniques in recovering and interpreting data; laboratory exercises in ceramic and lithic analysis. Critical evaluation of archaeological literature. Prereq: Anth 412 or permission. 4 cr.

**516. KINSHIP AND SOCIAL ORGANIZATION**
The significance of kin and nonkin relations in human societies. Topics include the origins and evolution of human society, variations in the form and functions of marriage, family, and kin-based groups and selected nonkin relationships. Primary focus will be on nonindustrial societies. Prereq: Anth 411 or permission. 4 cr.

**518. HISTORY OF ANTHROPOLOGICAL THEORY**
Reading and discussion of the works of major theoreticians of American, British, and French schools. Selections from the works of Spencer, Morgan, Tylor, Boas, Kroeber, Lowie, Steward, White, Durkheim, Mauss, Levi-Strauss, Malinowski, Radcliffe-Brown, Evans-Pritchard, and others are treated in terms of their contributions to the historical development of anthropology and their relevance to contemporary debates in anthropological theory. Prereq: Anth 411 or permission. 4 cr.

**614. ECONOMIC ANTHROPOLOGY**
Economics of nonindustrial societies; definition of economics; production, distribution, and consumption in selected societies; development. Prereq: Anth 411 or permission. 4 cr.

**616. ANTHROPOLOGY OF RELIGION**
Major anthropological theories of religion; analysis of religious beliefs as symbolic systems and their interrelations with ritual and other social institutions. Detailed study of specific religions. Prereq: Anth 411 or permission. 4 cr.

**618. POLITICAL ANTHROPOLOGY**
Political processes and structures in nonindustrial societies. Major topics: centralization of power and authority, legal systems, and warfare. Prereq: Anth 411 or permission. 4 cr.

**625. FEMALE, MALE, AND SOCIETY**
A critical, cross-cultural study of sex-related behavior in historical as well as contemporary perspective. Draws on anthropological, social-psychological, and sociological literature. Prereq: Anth 411 or Soc 400;/or permission. 4 cr.

**630. ANTHROPOLOGICAL FIELD RESEARCH**
Explores in theory and practice a range of approaches to doing field studies in anthropology. Techniques such as life histories, questionnaires, projective tests, participant observation, and field diaries will be explored in class and through active participation in a class research project. Prereq: Anth 411; one 500-level or higher anthropology course;/or permission. 4 cr.

**697. SPECIAL TOPICS IN ANTHROPOLOGY**
New or specialized courses presenting material not normally covered in regular course offerings. May be repeated, but not in duplicate areas. Course descriptions on file in department office during registration. A) Social Organization; B) Economic Anthropology; C) Anthropology of Religion; D) Political Anthropology; E) Development; F) Cultural Ecology; G) Prehistoric Archaeology; H) Historic Archaeology; I) Cultural Resources Conservation; J) Lithic Analysis; K) Ceramic Analysis; L) Faunal Analysis; M) Human Evolution; N) Human Variation. Prereq: Anth 411 or 412 (as appropriate);/or permission. 4 cr.

**699. SENIOR THESIS**
Independent work in the library or field; recommended for, but not confined to, majors intending to pursue graduate studies; required for honors candidates. Contact staff to obtain approval and arrange supervision. Should be taken next-to-last semester before graduation. 4 cr.

**714. ANTHROPOLOGY OF COMPLEX SOCIETIES**
Peasants, urban communities, race and ethnicity, stratification, local-national integration, the effects of colonialism, modernization, and social change. Primary emphasis is on the comparative and cross-cultural analysis of non-Western societies. Prereq: Anth 411 or permission.

**731, 732. AREA STUDIES IN ARCHAEOLOGY**
A) South America; B) Mesoamerica; C) North America; D) Other. Offered as staff is available and student needs dictate. Prereq: Anth 412; Anth 514;/or permission. 4 cr.

**747. AREA STUDIES IN SOCIAL AND CULTURAL ANTHROPOLOGY**
A) South America; B) Mesoamerica; C) North America; D) Oceania; E) Southeast Asia; F) Africa; G) Middle East; H) South Asia; I) Other. Offered as staff is available and student needs dictate. Characteristic ecological, historical, and socio-cultural factors. Analysis of selected societies and institutions. Prereq: Anth 411 or permission. 4 cr.

**775. SELECTED TOPICS IN ANTHROPOLOGICAL THEORY**
Examination of selected approaches or schools of historical or current interest. May be repeated but not in duplicate areas. Course descriptions on file in department office during registration. A) Cultural/Social Anthropology; B) Archaeology; C) Physical Anthropology. Prereq: Anth 411 and 518 or 412 and 518 as appropriate;/or permission. 4 cr.

**795, 796. READING AND RESEARCH IN ANTHROPOLOGY**
A) Cultural/Social Anthropology; B) Anthropological Linguistics; C) Archaeology; D) Physical Anthropology. Prereq: 12 credits of anthropology; permission. Variable (normally 2-8) cr.

**797. SPECIAL TOPICS IN ANTHROPOLOGY**
New or specialized courses presenting material not normally covered in regular course offerings. May be repeated, but not in duplicate areas. Course descriptions on file in department office during registration. A) Social Organization; B) Economic Anthropology; C) Anthropology of Religion; D) Political Anthropology; E) Development; F) Cultural Ecology; G) Prehistoric Archaeology; H) Historic Archaeology; I) Cultural Resources Conservation; J) Lithic Analysis; K) Ceramic Analysis; L) Faunal Analysis; M) Human Evolution; N) Human Variation. Prereq: Anth 411 or 412 (as appropriate);/or permission. 4 cr.

## Sociology (Soc)

**400. INTRODUCTORY SOCIOLOGY**
Human social and cultural relationships as revealed in customs and institutions. Social theory, methods and techniques of research, and current research findings. Laboratory-problem method of instruction is offered occasionally; students interested should register for the section identified as "Laboratory" in the Time and Room Schedule. 4 cr.

**500. SOCIAL PSYCHOLOGY**
Individual actions, attitudes, ideas, and perceptions as influenced by socio-cultural environments. Individual-cultural relations in education, religion, economics, aesthetics, ethics, and deviant behavior. 4 cr.

**520. THE FAMILY**
An anthropological and institutional approach comparing societal customs and organizations. Laboratory-problem method of instruction is offered occasionally; students interested should register for the section identified as "Laboratory" in the Time and Room Schedule. 4 cr.

**530. RACE AND ETHNIC RELATIONS**
Majority-minority group relations; special attention to nature and results of Black-white and ethnic group relations in the United States. 4 cr.

**540. SOCIAL PROBLEMS**
Relation of customs and institutions to crime, delinquency, alcoholism, physical and mental disease, sexual aberrations, poverty, old age, broken families, and racial and religious prejudices. Especially for nonmajors. 4 cr.

**560. RURAL-URBAN SOCIOLOGY**
Application of sociological and social psychological principles to the study of populations at various points on the rural-urban continuum. 4 cr.

**600. SOCIAL INSTITUTIONS**
Relationships among education, religion, economy, government, paedotrophic and inter-sex practices, art, and recreation. Cross-cultural approach. 4 cr.

**601. METHODS OF SOCIAL RESEARCH**
Cross-sectional and longitudinal survey design; direct and indirect measurement techniques; design of field and laboratory experiments; special topics. Prereq: major in sociology or social service;/or permission. 4 cr.

**602. STATISTICS**
Elementary applied statistical techniques; descriptive statistics; cross-tabulation, correlation, probability, hypothesis testing, analysis of variance. 4 cr.

**611. HISTORY OF SOCIAL THEORY**
Background and early formulation. Writings of classical social thinkers from Plato to Max Weber. 4 cr.

**612. CONTEMPORARY SOCIOLOGICAL THEORY**
Major schools of contemporary sociological theory; functionalism, "verstehen" sociology, symbolic interactionism, reform sociology, neopositivism, and formal theory construction. 4 cr.

**615. INTRODUCTORY CRIMINOLOGY**
Scientific study and control of crime. Indexes, rates, theories of crime and delinquency, police, courts, probation, prison, and parole. 4 cr.

**629. SMALL GROUPS**
Interaction among individuals in small groups and between small groups; perception, attitude, and behavior. Analytical techniques are applied. A prior course in social psychology is recommended. 4 cr.

**699. SENIOR THESIS**
Independent work in the library or field; recommended for, but not confined to, majors intending to pursue graduate studies; required for honors candidates. Contact staff to obtain approval and arrange supervision. Should be taken next-to-last semester before graduation. 4 cr.

**720. CURRENT DEVELOPMENTS IN SOCIOLOGY OF THE FAMILY**
A current topic will be selected each semester, such as stratification and the family, intrafamily communication, power structure of the family, kinship in modern societies. Critical review of the literature; class or individual research project usually will be carried out. Prereq: 8 credits of sociology; Soc 520 recommended. 4 cr.

**721. FAMILY INTERACTION**
Analysis of family interaction from a sociological perspective. Consideration of individual family members, relationships, and the family as a unit using a social systems approach. Prereq: Soc 400 or permission. 4 cr.

**735. COMPLEX ORGANIZATIONS**
Comparative study of the structure and dynamics of complex, formal organizations (business, military, political, and governmental, educational, medical). Power and social control in formal systems; organizational processes, performances, and effectiveness; impact of complex, formal organizations on persons and societies. Prereq: permission. 4 cr.

**740. CULTURE CHANGE**
Various types of society; development of theory. Descriptive studies of institutional as well as theoretical materials selected from the writings of Comte, Marx, Spencer, Durkheim, Spengler, Sorokin, Redfield, and others. 4 cr.

**741. SOCIAL CHANGE AND SOCIETAL DEVELOPMENT**
Comparative, interdisciplinary approach. Interrelationships among economic, political, and social factors in determining the structure, dynamics, character, and level of development of societies. Prereq: permission. Soc 740 recommended. 4 cr.

**745. SOCIAL STRATIFICATION**
Pattern of distribution of economic, honorific, and political variables within the populations of complex societies; allocation of personnel to the roles in question, notably through occupational mobility; and the impact of such processes upon behavior, both individual and social. Prereq: Soc 400 or 600. 4 cr.

**757. SOCIAL INSTITUTIONS OF LATIN AMERICA AND THE CARIBBEAN**
Selective analysis of distinctive institutions and social systems, with particular attention to social aspects of the process of modernization. Prereq: permission. 4 cr.

**761. POPULATION DYNAMICS**
Major population trends including changes in birth and death rates, population characteristics, mobility, migration, world population growth, population problems, and policies of countries at different stages of economic development. Interrelationship of population and society. 4 cr.

**770. CULTURE, PERSONALITY, AND SOCIETY**
A cross-cultural view of the development of personality as emergent from genetic, situational, and socio-cultural determinants; analysis of the dynamic interplay of socio-cultural and psychological behavior systems. Prereq: prior courses in sociology, anthropology, or psychology. 4 cr.

**780. SOCIAL CONFLICT**
Nature of social conflict, especially war. Setting and initiation of conflict, its dynamics, and factors affecting its course and outcomes. Prereq: permission. 4 cr.

**785. THE STUDY OF WORK**
Understanding society through the structure of work. Case studies, in an ethnographic manner, of high-status and low-status occupations to provide understanding of social processes and interrelationships in the social structure. 4 cr.

**790. APPLIED SOCIOLOGY**
1) Current level of use of sociological knowledge; 2) the advocate, consultant, and researcher roles in applied settings; 3) techniques of applied research; 4) implications of applied sociology, including ethical problems. Each student will focus on a social problem and write a paper covering the above issues. Applied projects where possible. Prereq: Soc 601. 4 cr.

**795, 796. READING AND RESEARCH IN SOCIOLOGY**
A) Communications; B) Criminology; C) Culture Change; D) Culture and Personality; E) Deviant Behavior; F) Family; G) Population; H) Rural-Urban; I) Social Control; J) Social Differentiation; K) Social Movements; L) Social Psychology; M) Social Research; N) Social Theory. Prereq: 12 credits of sociology or permission. Variable (normally 2-8) cr.

**797. SPECIAL TOPICS IN SOCIOLOGY**
New or specialized courses presenting material not normally covered in regular course offerings. May be repeated, but not in duplicate areas. Course descriptions and prerequisites on file in department office during registration. A) Criminal Justice Field Work; B) Sociology of Crime and Justice; C) Sociology of Mental Health and Illness; D) Illness and Society; E) The Holocaust; F) Socio-Linguistics; G) Social Class and Family Patterns; H) Measurement in Sociology; I) Violence in the Family; J) Post-Industrial Society; K) Political Sociology; L) Bio-Sociology; M) Social Evolution; N) Social Differentiation; O) Modernization; P) Blacks in the Americas. 4 cr.

# Soil Science

(See Institute of Natural and Environmental Resources)

# Spanish

(See Ancient and Modern Languages and Literatures)

# Technology (Tech)

**Dean:** Richard S. Davis

The following courses are not necessarily offered every year.

**405. INTRODUCTION TO COMPUTER TECHNOLOGY AND APPLICATIONS**
Computer hard- and software; demonstrations, some "hands-on" experience with hardware, and some programming. Advantages and limitations of computers with respect to various applications (e.g., data processing, automation, education); impact on society (e.g. employment, privacy, war). No credit subsequent to C S 410, E E 712, 714. 4 cr.

**610. INTRODUCTION TO OCEAN ENGINEERING**
Seminar dealing with engineering problems in fields of current oceanographic interest. Marine biology, saturation diving systems, and physical oceanography. Engineering faculty and other experts in ocean science and engineering. Prereq: permission. 4 cr.

**650. COOPERATIVE WORK EXPERIENCE**
Course required of all students participating in the College of Engineering and Physical Sciences Cooperative Program during employment semesters. Prereq: permission. 0 cr. Cr/F.

**683. TECHNOLOGY: ITS ROLE AND FUNCTION IN SOCIETY**
Impact of technology on social systems with current and historical examples. Interrelations between social customs, psychological responses, physical needs, and technological developments. Decision-making process in technological change; interrelationship between technology and public policy. Prereq: junior and senior standing; permission. 4 cr.

**697. OCEAN PROJECTS**
Students work as members of interdisciplinary project teams on contemporary ocean-related problems under the guidance of a faculty adviser. Student team defines problem, prepares a budget, conducts literature surveys, engages in dialogue with experts in the ocean community, deals with vendors, designs and builds a working engineering model or conducts a comprehensive study, makes interim reports, and defends its results before a jury of experts. Prereq: normally senior standing and permission of the course director. A year-long course: 2 credits each semester, 4 credits total, an "IA" grade (continuous course) given at the end of the first semester. 4 cr.

# Theater and Communication (ThCo)

**Chairperson:** David J. Magidson

**Professors:** Joseph D. Batcheller, John C. Edwards
**Associate Professors:** Carol Lucha Burns, Gilbert D. Davenport, David J. Magidson, Wilburn Sims
**Assistant Professors:** Raymond J. Bernier, Jean M. Brown, Kenneth Sweet, Tracey Bernstein Weiss
**Lecturers:** Kathy Anastasion, Patricia Fleming-Desrosiers, Paula Geyser, Susan E. Goldin, Judith Hartwell, Jeffrey Martin, Jean Mattox, Maurice Quirin, C. Lawrence Robertson, Elizabeth Sanner, Thomas E. Scharff, Peter Spain, James H. Tolhuizen

## Communication

**402. COMMUNICATION I**
Interpersonal and intrapersonal. Student's awareness of his/her role in communication. Open to freshmen and sophomores. 4 cr.

**403. PUBLIC SPEAKING**
Sensitizes speakers and listeners; understanding and adapting to receivers, idea selection and development, message organization, and delivery. Nonverbal communication. 4 cr.

**404. INTRODUCTION TO ARGUMENTATION**
Principles of inquiry and advocacy. Philosophical and logical frameworks of argument; analysis, discovery and testing of data; forms of argument; testing of argument; patterns of proof and evidence. Argumentation as advocacy. 4 cr.

**405. ARGUMENTATION WORKSHOP**
Basic principles of rational decision making through argumentation. Application in debate formats. May be repeated. Prereq: ThCo 404. 2 cr.

**501. ARGUMENTATION II**
Argument and advocacy as action on minds by means of discourse. Presumptions, hierarchies, loci, presentation of data and the form of the discourse, ethical and logical duties of the advocate. Examinations of arguments by politicians, lawyers, or others who advance propositions of fact, value, or policy. Prereq: ThCo 404; ThCo 405;/or permission. 4 cr.

**502. INTERPERSONAL LABORATORY**
Integrates interpersonal theory and practice in a laboratory setting. Prereq: ThCo 402 and permission. 4 cr.

**503. INTRODUCTION TO GROUP PROCESSES**
Communication behavior in small groups. Problem-solving procedures, leadership, behavioral patterns, communication interaction patterns. Prereq: ThCo 402 or 403;/or permission. 4 cr.

**506. PERSUASION**
Advanced course on problems of influencing human behavior. Practical applications. Prereq: ThCo 403 or permission. 4 cr.

**555. INTRODUCTION TO MASS COMMUNICATION**
Nature, development, and effects on our society. Television effects and production techniques. Prereq: permission. 4 cr.

**556. INTRODUCTION TO TELEVISION PRODUCTION**
Theory and actual studio experience, practice, and procedures. All aspects of television work and formats. Students operate every piece of studio equipment and write, produce, and direct several shows. Prereq: ThCo 555 or permission. 4 cr.

**567. IMAGES OF WOMEN IN THE MEDIA**
Portrayal of women in a variety of media. Communication research methodologies employed to examine media attempts to persuade, reinforce, and manipulate attitudes. 4 cr.

**572. LANGUAGE AND BEHAVIOR**
Human symbol-using capacity and effects of language on behavior. Ways in which symbols help create individual realities, reflect levels of personal judgment and adjustment, facilitate or hinder interpersonal communication. Application to verbal and nonverbal communication, and contemporary and social issues. 4 cr.

**595. SPECIAL TOPICS IN COMMUNICATION**
Individual or group projects primarily in the communication option. By permission and arrangement with appropriate faculty. (May be repeated). 2, 4, 6, or 8 cr.

**602. THEORIES OF INTERPERSONAL AND GROUP COMMUNICATION**
Contemporary perspectives on interpersonal and group communication; analytical emphasis on human communication behavior. Prereq: ThCo 402; at least one 500-level Communication course. 4 cr.

**608. COMMUNICATION ANALOGS**
Pragmatic analysis of communication problems. The level structure of human communication, system interaction and metacommunication, and paradoxes of communication behavior are examined through analogs and axioms of behavior as communication. Prereq: ThCo 402; at least one 500-level communication course. 4 cr.

**630. PSYCHOLOGY OF COMMUNICATION**
Concept-reference; vocal, visual, and verbal cues and attention. Prereq: ThCo 402; at least one 500-level communication course. 4 cr. (Not offered every year.)

**632. COMMUNICATION THEORY**
Terminology, concepts, theoretical models, functions, levels, modes and media, and role taking in human communication. Prereq: ThCo 402; any 500-level communication course;/or permission. 4 cr.

**656. PRINCIPLES OF RHETORICAL CRITICISM**
Roles and methods of rhetorical critics. Historical background to rhetorical-critical structures and processes including neo-Aristotelian criticism and Burkeian criticism. Critical principles and practices. Seminar. Prereq: ThCo 403 or permission. 4 cr.

**673. EXPERIMENTAL AND DESCRIPTIVE STUDIES IN ORAL COMMUNICATION**
Prereq: permission. (May be repeated.) 4 cr.

**695. COMMUNICATION SEMINAR**
An upper-level seminar; variable topics in communication research, theory, and practice. May be repeated for different topics. 4 cr.

**750. WRITING FOR PERFORMANCE**
See theater offerings. 4 cr.

**771. CRITICISM OF CONTEMPORARY RHETORIC**
Applies rhetorical-critical systems and principles. Campaign rhetoric, agitative rhetoric, the rhetoric of religion, the rhetoric of militarism, the rhetoric of diplomacy, and the rhetoric of social movements. Course content variable. Prereq: ThCo 656 or permission. 4 cr.

**772. MEDIA AESTHETICS**
Seminar. Aesthetic principles of film, television, radio, and other media applied to current examples in politics, advertising, entertainment, etc. Prereq: permission. 4 cr. (Not offered every year.)

**783. THEORIES OF LANGUAGE**
Nature, uses, and roles of language. Representative theorists include Carroll, Piaget, Sapir, Whorf, Vetter, Vygotsky, Weiner, Chomsky, Labov, Steward, Ogden and Richards, Ruesch, and Sullivan. Prereq: permission; or ThCo 572 and 673. 4 cr. (Not offered every year.)

## Dance

**461. MODERN DANCE I**
An introductory course which includes techniques and improvisation as well as lectures in history and theory. 4 cr.

**462. BALLET I**
Introductory course; technique; historical development of ballet. 4 cr.

**463. THEATER DANCE I**
Introductory course; techniques; improvisation; lectures on jazz, ethnic, and other theatrical dance forms. 4 cr.

**470. THEATER MOVEMENT**
Stage movement for actors. Open to theater majors only. 2 cr.

**561. MODERN DANCE II**
Intermediate level course which includes techniques and improvisation. (May be repeated for credit.) Prereq: ThCo 461 or permission. 2 cr.

**562. BALLET II**
Extension of Ballet I syllabus; emphasis is on technique, with additional step vocabulary. Prereq: ThCo 462 or permission. 2 cr.

**563. THEATER DANCE II**
Technique; Afro-Cuban, modern, and East Indian dance; body movement through exercises and combinations involving stretch, strength, and flexibility. Prereq: ThCo 463 or permission. 2 cr.

**633. DANCE COMPOSITION I**
Practical, developmental approach to process of creating dances. Prereq: ThCo 561 or permission. 2 cr.

**634. DANCE COMPOSITION II**
Use of music; group choreography. Prereq: ThCo 633. 2 cr.

**638. THE DANCE**
Historical and philosophical consideration of dance trends. 4 cr.

**640. LABANOTATION**
Study and practice of recording human movement by the method of Labanotation. Prereq: permission. 2-4 cr.

**661. MODERN DANCE III**
Advanced-level course in technique and composition. (May be repeated for credit.) Prereq: ThCo 561 or permission. 2 cr.

**684. SPECIAL TOPICS IN DANCE**
Exploration of topics agreed upon by students and instructor. (May be repeated.) Topics vary. 2-4 cr.

**732. CHOREOGRAPHY**
Theoretical and practical consideration of the creative and aesthetic aspects of various forms of the dance. Prereq: ThCo 561 or permission. 4 cr.

## Theater

**435. INTRODUCTION TO THEATER (THEATER AND ITS DRAMA I)**
Emphasis on modern theater forms; e.g., legitimate, musical, cinema, television. Survey of theater areas, personnel, and methods. Attendance at University Theater and Allied Arts productions. Minimal participation in laboratory and major productions. 4 cr.

**436. HISTORY OF THEATER AND DRAMA (THEATER AND ITS DRAMA II)**
History and theory in its social framework from the beginnings to 1800. 4 cr. (Not offered every year.)

**438. HISTORY OF THEATER AND DRAMA (THEATER AND ITS DRAMA III)**
1800 to present. 4 cr. (Not offered every year.)

**457. ORAL INTERPRETATION**
Analysis of literature for performance; demonstration and experimentation with performance methods; development of a critical standard for evaluation of performance and literature. 4 cr.

**459. STAGECRAFT (SCENIC ARTS I)**
Stage scenery construction and painting. Properties, sound, and backstage organization. Survey of costumes and lighting. Practical application in University Theater productions. 4 cr.

**475. STAGE MAKEUP**
Fundamentals of juvenile, old age, character, and special stage makeup techniques. Prereq: permission. Lab fee: $20. 2 cr.

**481. SUMMER REPERTORY THEATER WORKSHOP**
1) Class in voice, movement, makeup, and improvisation taught by the directors and professional actors of the resident company. 2) Technical aspects of scenery, costumes, lighting, publicity. 3) Performance in Summer Theater production with experienced resident actors. Admission to workshop by audition only. Offered in the eight-week summer session. 8 cr.

**520. EDUCATION THROUGH DRAMATIZATION**
Puppetry, storytelling, involvement theater, creative dramatics, and story theater for children; application to the classroom, playground, recreation center, library, hospital ward. Prereq: permission. 4 cr.

**541. ARTS ADMINISTRATION**
Contemporary arts administration; theories and techniques of cultural resource development, organization, structure, labor relations, marketing, consumer behavior, public relations, fund raising, audience development, and long-range planning. 4 cr.

**546. STAGE COSTUME DESIGN AND EXECUTION (SCENIC ARTS II)**
Costume history, styles, design, theory, patternmaking, and construction. Prereq: permission. 4 cr.

**547. STAGE PROPERTIES**
Research and manufacture of period and modern stage, trim, and hand properties. Prereq: ThCo 459. 4 cr.

**548. STAGE LIGHTING DESIGN AND EXECUTION (SCENIC ARTS III)**
Elementary electricity, design theory, instrumentation, control, and practice. 4 cr.

**549. VOICE AND DICTION I**
Based on individual needs; particular reference to theater, television, radio. Individual and group practice session. Coreq: ThCo 551. Prereq: permission. 2 cr.

**550. VOICE AND DICTION II**
Basic skills for oral interpretation, theater, etc., including analysis and development of dialects. Coreq: ThCo 552. Prereq: ThCo 549. 2 cr.

**551. ACTING I**
Development of fundamental vocal and physical stage techniques for actors and directors through exercises, improvisation, and theater games. Should be taken concurrently with ThCo 549. 2 cr.

**552. ACTING II**
Application of prior training in ThCo 551 (prerequisite) to building characterizations in scenes and short plays. Should be taken concurrently with ThCo 550. 2 cr.

**583. PUPPETRY**
Emphasis on puppet making and production. Students provide own materials. Prereq: permission. 4 cr.

**621. CREATIVE DRAMATICS**
Pantomime, improvisation, and storytelling. Students are expected to work with the Durham Drama for Youth program. Prereq: ThCo 520. 4 cr.

**622. THEATER FOR CHILDREN**
The art of story theater production, storytelling and involvement and both school and recreation programs. Students will observe and take part in the production of a play for children. 4 cr.

**624. MUSICAL THEATER FOR CHILDREN**
Musical production and writing techniques. Students take part in actual production. 4 cr.

**627. METHODS OF EDUCATION THROUGH DRAMATIZATION**
Materials and technique practicum for teaching material in ThCo 520. (Division of Continuing Education only.) Prereq: permission. 2-4 cr.

**652. SCENE DESIGN (SCENIC ARTS IV)**
Stage drafting, modules, materials, design theory, and styles. Individualized exercises, final project. Prereq: ThCo 459. 4 cr.

**653. PERFORMANCE PROJECT**
Application of acting and directing theory to assigned responsibilities in a University Theater production or to an individual performance project. Prereq: ThCo 551; 552; permission. To be taken in conjunction with ThCo 654, but not concurrently. May be repeated to 4 cr. 2 cr.

**654. SCENIC ARTS PROJECT**
Application of experience in design and technical aspects to assigned responsibilities in a University Theater production or to an individual project or presentation. Prereq: ThCo 459; 652; permission. To be taken in conjunction with ThCo 653, but not concurrently. May be repeated to 4 cr. 2 cr.

**655. MUSICAL COMEDY WORKSHOP**
Emphasis on developing audition, performance, and directing techniques, analysis. By audition only. 4 cr.

**657. DIRECTING**
Continuation of ThCo 552 (prerequisite). The director and performer develop interaction of the character. Ensemble playing. Full directing responsibility for a one-act play. 4 cr.

**693. THEATER MANAGEMENT I**
Theater organization, fund raising, public relations, audience development, and business and box-office management of University Theater projects. Special topics may be explored. Prereq: four courses in theater. 4 cr.

**729. COMMUNITY-ORIENTED DRAMA PROGRAMS**
Students develop programs and work in communities. 4 cr.

**730. THEATER MANAGEMENT II**
Theory and technique of theater management applied to a specific assignment; may involve internships with professional, community, or educational theaters. Prereq: ThCo 693. 4 cr.

**741. PLAY ANALYSIS FOR PRODUCTION**
Analysis and discussion to develop production concepts for actors, technicians, directors, designers, teachers. Prereq: ThCo 435, 436, or 438; either 459, or 551 and 552. 4 cr. (Not offered every year.)

**750. WRITING FOR PERFORMANCE**
Playwriting; radio, television, and film. Emphasis will vary. Focus on original work with possible performances in other classes. May be taken three times for credit. Prereq: permission. 4 cr.

**755. MUSICAL THEATER STYLES**
Representative scripts and scores depicting various American musical performance styles. Prereq: ThCo 655. Lab. 4 cr.

**758. ACTING III**
Continuation of ThCo 657 and of the sequence begun in ThCo 551 and 552. Styles of drama for the actor and director. Greek, Shakespearean, 18th-century comedy, and 19th-century realism. Prereq: ThCo 551; 552; 657;/or equivalent. 4 cr.

**768. GROUP INTERPRETATION**
Choric speaking, reader's theater, chamber theater, and other forms of group interpretation in theory and practice. Prereq: ThCo 457. 4 cr.

**781. THEATER WORKSHOP FOR TEACHERS**
Intensive seminar-workshop. Rehearsal techniques, theater production, and stage direction; work in lab and in summer repertory theater production as applicable to secondary-school theater. Offered in the summer session. 4 cr.

**782. THEATER WORKSHOP FOR TEACHERS**
Continuation of ThCo 781 (not a prerequisite). Offered in the summer session. 4 cr.

## General

**691. LABORATORY OR FIELD EXPERIENCE**
Taken in the senior year. 4 cr.

**697. SENIOR SEMINAR**
Divisional and departmental meetings as preparation for senior project; overview of recent developments and trends in the oral-communication arts and sciences. Prereq: senior standing. 2 cr.

**698. SENIOR PROJECT**
Further development and completion of senior project. Prereq: senior standing. 2 cr.

**795, 796. INDEPENDENT STUDY**
Application of speech communication or theater theory in individual or group projects. Could be combined with senior project (for majors) for a total of 12 credits in the same semester if the student wishes to study off-campus. Project is to be developed with supervising instructor. May be repeated. 2, 4, 6, or 8 cr.

# Thompson School of Applied Science (TSAS)

**Director:** Lewis Roberts, Jr.

**452. PLANT PROPAGATION**
Reproduction of plants for horticultural purposes by sexual and asexual methods. Seeds, cuttings, separation, division, layering, grafting, budding, and in vitro propagation. Prereq: APS 251 or permission. Lab. 3 cr.

**453. NURSERY CULTURE AND OPERATION**
Development of a nursery business from site selection to marketing the finished product. Special attention to managing the operation. Prereq: APS 247 or permission. Lab. 3 cr.

**457. CONTROLLED GROWTH STRUCTURES**
Various growth structures used in the horticultural industry: greenhouses, lath houses, cold frames, etc.; construction, selection of heating, watering systems, scheduling of light requirements, and efficient use of space. Prereq: permission. Lab. 4 cr.

**458. SPRING TRANSPLANT PRODUCTION**
The study of leading bedding/annual plants, vegetable seedlings, perennials, and herbs, including cultural requirement, crop timing, distribution systems, and marketing principles. Prereq: permission. Lab. 3 cr.

**459. FLORICULTURAL CROP PRODUCTION**
The study of leading cut flower crops, potted plants, and bulbous crops including cultural requirement, crop timing, harvesting procedures, distribution systems, and marketing principles. Prereq: permission. Lab. 3 cr.

# Wildlife Management

(See Institute of Natural and Environmental Resources)

# Women's Studies (W S)

**Coordinator:** Josephine Donovan

**401. INTRODUCTION TO WOMEN'S STUDIES**
Interdisciplinary survey of the major areas of women's studies: women's history, cross-cultural perspectives, women in literature, psychology of women, etc. Basic principles and concepts fundamental to more advanced women's studies research. Topics vary. Recommended for W S minors. 4 cr.

**698. SENIOR SEMINAR**
Intensive study of specialized topic for advanced students. Topics vary with instructor. Prereq: permission. Preference given to women's studies minors who have completed 12 W S cr. Barring duplication of topic, may be repeated for credit. 4 cr.

# Zoology (Zool)

**Chairperson:** John E. Foret

**Professors:** Lorus J. Milne, emeritus; Emery F. Swan, emeritus; Edythe T. Richardson, emerita; Arthur C. Borror, Wilbur L. Bullock, Frank K. Hoornbeek, John J. Sasner, Philip J. Sawyer, Paul A. Wright
**Associate Professors:** Paul E. Schaefer, emeritus; Robert A. Croker, John E. Foret, James F. Haney, Larry G. Harris, Marcel E. Lavoie, Edward K. Tillinghast
**Assistant Professors:** Edward N. Francq, Roderick M. Smith, James T. Taylor, Charles W. Walker, Winsor H. Watson, III
**Lecturer:** Abigail R. Lumsden

**412. PRINCIPLES OF ZOOLOGY**
Concepts of animal biology, introduction to ecological relationships, anatomy, physiology, embryology, taxonomy, and evolution. Intended principally for majors in the biological sciences. Lab. 4 cr.

**504. HEREDITY AND EVOLUTION**
Gene and chromosal basis of variation and evolution: chemical, physical, and statistical concepts. Prereq: biological science or health studies major;/or permission. (Students may not receive credit for both Zool 504 and 604.) 4 cr.

**507-508. HUMAN ANATOMY AND PHYSIOLOGY**
All systems in human body. Laboratories: a dissection of preserved cats and experiments with living tissues. Lab fee $5. 4 cr.

**518. VERTEBRATE MORPHOLOGY**
Basic morphological features of vertebrates. Structure of the major systems at macroscopic and microscopic levels. Prereq: Zool 412. Lab. 4 cr.

**527. VERTEBRATE PHYSIOLOGY**
Principles and comparative function of vertebrate systems; cell, organ, and system levels. Prereq: Zool 412, 518; Chem 403-404. Lab. 4 cr.

**528. INTRODUCTORY INVERTEBRATE ZOOLOGY**
Lecture and laboratory survey of invertebrate phyla; systematic morphology, phylogeny, and natural history. Prereq: Zool 412;/or equivalent. Lab. 4 cr.

**537. COMPARATIVE INVERTEBRATE PHYSIOLOGY**
Principles and comparative function of cell, organ, and system levels of invertebrate respiration, circulation, fluid regulation, energetics, coordination, and neuroendocrine mechanisms. Prereq: Zool 528 or equivalent; Chem 403-404. Lab. 4 cr.

**542. ORNITHOLOGY**
Identification and biology of birds, especially those of northeastern United States. Field trips, laboratory, and lectures. Prereq: one semester of biology. 4 cr.

**604. PRINCIPLES OF GENETICS**
Chemical and physical basis of inheritance; genes and chromosomes as units of mutation; genes in populations. Prereq: basic laboratory course in biological sciences. Organic chemistry and college math or statistics suggested. (Offered as PlSc 604 alternate semester.) Students may not receive credit for both Zool 504 and 604. 4 cr.

**620. INTRODUCTORY MARINE SCIENCE FOR TEACHERS**
Primarily for teachers grades 6 through 12, but open to others. Overview of living marine organisms (algae, invertebrates, fishes, marine mammals, and shore birds) in their natural environment. Also such topics as coastal zone problems, marine fisheries, economics of marine organisms, and the educational resources of the marine environment. Field work. Offered at the Isles of Shoals (Shoals Marine Laboratory) in cooperation with Cornell University. Three lectures and two labs or field trips per day. Prereq: college-level introductory biology. 1 cr. Cr/F. (Summers only)

**628. DEVELOPMENTAL BIOLOGY OF THE INVERTEBRATES**
Principles of animal development including metamorphosis and regeneration in representative invertebrates. Prereq: Zool 528. Lab. 4 cr.

**629. DEVELOPMENTAL BIOLOGY OF THE VERTEBRATES**
Principles of animal development including metamorphosis, regeneration, and aging in selected vertebrates. Prereq: Zool 518, 527, and 604. Lab. 4 cr.

**674. INTRODUCTION TO MARINE SCIENCE**
Daily lectures; laboratory and field work. Offered at the Isles of Shoals in cooperation with Cornell University. Summers only. Prereq: at least a full year of college biology. 5 cr. Cr/F.

**704. COMPARATIVE ENDOCRINOLOGY**
Endocrine organs; relationship to control of the internal environment, growth, development and adaptation to external environment. Prereq: vertebrate anatomy; physiology; organic chemistry. 4 cr.

**707. HUMAN GENETICS**
Inheritance patterns; gene and chromosome mutation rates and effects; linkage and gene frequency. Prereq: Zool 604 or equivalent;/or permission. 4 cr. (Not offered every year.)

**711. NATURAL HISTORY OF COLD-BLOODED VERTEBRATES**
Classes of poikilothermic vertebrates; their habits, habitats, and life histories in eastern North America. Prereq: general zoology; Zool 518. Lab. 4 cr.

**712. MAMMALOGY**
Origins, diversification, reproduction, ecology, behavior of mammals. Identification of local forms. Prereq: Zool 412; 518. Lab. 4 cr.

**713. ANIMAL BEHAVIOR**
Individual and social behavior. The role of anatomy, physiology, ecology, and prior experience. Techniques and practical application. Prereq: one year of zoology. Lab. 4 cr.

**715. NATURAL HISTORY OF MARINE INVERTEBRATES**
Field and laboratory course; inshore marine invertebrate metazoan animals of northern New England. Identification, classification, habitat preferences, and behavior. Work (collection and observation) constitutes a major part of the course. Some travel expense. Prereq: general zoology. 6 cr. (Summer only.)

**717. GENERAL LIMNOLOGY**
Special relationships of freshwater organisms to the chemical, physical, and biological aspects of the aquatic environment. Factors regulating the distribution of organisms and primary and secondary productivity of lake habitats. Prereq: Biol 541;/or equivalent. 4 cr.

**719. FIELD LIMNOLOGY**
Freshwater ecology examined through laboratory exercises with freshwater habitats. Methods to study freshwater lakes; interpretation of data. Seminars and occasional Saturday field trips. Prereq: present or prior enrollment in Bot 717, Zool 717, or equivalent; permission. 4 cr.

**721. PARASITOLOGY**
Introduction to the more important parasites causing disease in humans and animals. Living materials will be used as much as possible. Prereq: one year of zoology. Lab. 4 cr. (Not offered every year.)

**723. CELL PHYSIOLOGY**
Principles of chemistry and physics applied to understanding cell structure and function. Metabolic reactions and their control in relation to cell organization; genesis and function of specialized cells. Prereq: organic chemistry. Lab. 4 cr.

**724. MARINE PARASITOLOGY**
Diseases and parasites of marine fishes and shellfish; emphasis on the local estuarine environment. Prereq: one year of zoology. Lab. 4 cr. (Not offered every year.)

**730. VERTEBRATE HISTOLOGY**
Microscopic anatomy of vertebrate tissues and organs at the light microscope level; emphasis—mammalian histology; some comparative study of lower vertebrates. Prereq: Zool 508, 518, or equivalent. Lab. 4 cr.

**732. SOIL ZOOLOGY**
Faunal communities of terrestrial soils, their ecology and natural history. Effects of animal activities on soil processes and composition. Collection, extraction, and study methods. Independent projects. Prereq: Biol 541. 4 cr. (Not offered every year.)

**740. BIOLOGY OF ANIMAL REGENERATION**
Principles of regeneration in various animal phyla. Discussion of experimental studies supplemented by laboratory work with living animals. Prereq: Zool 412. Lab. 4 cr. (Not offered every year.)

**772. FISHERIES BIOLOGY**
Information and techniques used by fisheries biologists. Emphasis on fish life history, ecology, and economics as related to management techniques. Prereq: Zool 711 or equivalent; permission. Lab. 4 cr.

**775. INVERTEBRATE EMBRYOLOGY**
Comparative study of reproduction and early development in selected invertebrates, providing a classical approach to morphology of gonads, fertilization, cleavage, gastrulation, and formation of larvae. Prereq: Zool 674 (UNH), Biol Sci. 364 (Cornell), or invertebrate zoology. Offered at the Isles of Shoals in cooperation with Cornell University. Summer only. 4 cr. Cr/F. (Not offered every year.)

**777. INTRODUCTION TO NEUROBIOLOGY**
The nervous system, with emphasis on vertebrate and invertebrate preparations which most clearly demonstrate the basic concepts of neurobiology. Topics include: structure and function of neurons, development, cellular basis of behavior (sensory and motor systems), neuropharmacology, and neural plasticity (learning). Prereq: Zool 412 or permission. 4 cr.

**778. COMPARATIVE NEUROPHYSIOLOGY**
Designed for students of the behavioral and physiological sciences who wish to understand the basic electrophysiological properties of neurons and how they interact. Both invertebrate and vertebrate systems will be called upon to illustrate principles of synaptic transmission, integration, sensory information processing, and the control of movement. Prereq: Introduction to Neurobiology or permission. Lab. 4 cr.

**795, 796. SPECIAL PROBLEMS IN ZOOLOGY**
A) Biological Oceanography; B) Ecology; C) Endocrinology; D) Evolution; E) Developmental Biology; F) Genetics; G) Histology; H) History of Zoology; I) Invertebrate Zoology; J) Physiology; K) Vertebrate Zoology; L) Zoogeography; M) Zoological Techniques; N) Parasitology; O) Histochemistry; P) Protozoology; Q) Systematics; R) Animal Behavior; S) Teaching Practices. Students may elect one or more sections for advanced study. Reading, laboratory work, organized seminars, and/or conferences. Prereq: permission. (Limit of 12 credits from the sections of this course.) 1-4 cr.

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Concord, N.H. (1969-1978)

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**Richard J. Horan, B.S.**
Concord, N.H. (1977-1981)

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Plymouth, N.H. (ex officio)

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Durham, N.H. (ex officio)

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Keene, N.H. (ex officio)

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Student Member
Manchester, N.H. (1978-1979)

**Gretchen Schnare Taylor, A.B.**
Meriden, N.H. (1979-1981)

**Gordon O. Thayer, Ed.D.**
Mirror Lake, N.H. (1976-1980)

**Howard C. Townsend**
Commissioner of Agriculture
Lebanon, N.H. (ex officio)

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North Hampton, N.H. (1975-1979)

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Vice President for Academic Affairs

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Vice President for Budget and Administration

**Richard F. Stevens, M.Ed.**
Vice President for Student Affairs/Acting Dean of Students

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Dean of the School of Health Studies

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Dean of the Graduate School and Director of Research

**Charles B. Warden, Jr., Ph.D.**
Dean of the Whittemore School of Business and Economics

**Eugene A. Savage, M.Ed.**
Dean of Admissions

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Director of the Cooperative Extension Service

**William Kidder, M.A.**
Associate Dean of Students

**Edward J. Durnall, Ed.D.**
Director of the Division of Continuing Education

**Donald E. Vincent, Ph.D.**
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**Peter H. Hollister, B.A.**
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**Gail A. Biggiestone, M.S.**
Director of the Department of Intercollegiate Athletics for Women

**Andrew T. Mooradian, M.S.**
Director of the Department of Intercollegiate Athletics for Men

**Stephanie M. Thomas, M.A.**
Registrar

**Heidemarie C. Sherman, Ph.D.**
Ombudsman

# Faculty and Cooperative Extension Staff

## Faculty Emeriti
**(with length of service)**

**Abbott, Helen D.**
Associate Professor Emerita, Library; A.B., Wheaton College, 1929; S.B. in L.S., Simmons College, 1930; A.M. Middlebury College, 1939; (1943 to 1972)

**Adams, Arthur S.**
Former President and Consultant; Dipl., U.S. Naval Academy, 1918; M.A., University of California, 1926; Sc.D., Colorado School of Mines, 1927; (1948 to 1951, 1975 to 1976).

**Allen, Fred E.**
Professor Emeritus of Animal Sciences; B.S., University of New Hampshire, 1932; D.V.M., Ohio State University, 1936; (1940 to 1976).

**Babcock, Donald C.**
Professor Emeritus of Philosophy; B.A University of Minnesota, 1907; M.A., ibid., 1908; S.T.B., Boston University, 1912; D.H.L. (Hon.), University of New Hampshire, 1960; (1918 to 1956).

**Barraclough, Kenneth E.**
Professor Emeritus of Forestry, Extension Forester Emeritus; B.A., New York State College of Forestry, Syracuse University, 1921; M.F., Harvard University, 1940; (1926 to 1963).

**Bartley, Irving D.**
Associate Professor Emeritus of Music and University Carillonneur; B.M., Syracuse University, 1935; M.M., ibid., 1938; (1945 to 1968).

**Barton, Philip S.**
Director Emeritus, Thompson School of Applied Science and Thompson School Professor Emeritus of Applied Animal Science, B.S., University of New Hampshire, 1928; M.Ed., ibid., 1938; (1939 to 1969).

**Bingham, Sylvester H.**
Professor Emeritus of English; A.B., Dartmouth College, 1922; A.M., Harvard University, 1929; Ph.D., Yale University, 1937; (1936 to 1970).

**Bowring, James R.**
Professor Emeritus of Resource Economics; B.S.A., University of Manitoba, 1936, M.A., University of Alberta, 1940; Ph.D., Iowa State University, 1944, (1948 to 1976).

**Boynton, C. Hilton**
Professor Emeritus of Dairy Science and Extension Dairyman Emeritus; B.S., Iowa State College, 1934; M.S., ibid., 1940; Ph.D., Rutgers University, 1962; (1945 to 1972).

**Brackett, Thelma**
University Librarian Emerita; A.B., University of California, 1919; Certificate, California State Library School, 1920; D.H.L. (Hon.), University of New Hampshire, 1962; (1942 to 1961).

**Bratton, Karl H.**
Professor Emeritus of Music; B.M., University of Kansas, 1931; M.A., Teachers College, Columbia University, 1945; (1945 to 1971).

**Carroll, Herbert A.**
Professor Emeritus of Psychology; A.B., Bates College, 1923; A.M., Brown University, 1928; Ph.D., Columbia University, 1930; (1941 to 1962).

**Chapman, Donald H.**
Professor Emeritus of Geology; B.A., University of Michigan, 1927; M.A., ibid., 1928; Ph.D., ibid., 1931; (1931 to 1974).

**Conklin, James G.**
Professor Emeritus of Entomology; B.S., Connecticut Agricultural College, 1926; M.S., University of New Hampshire, 1929; Ph.D., Ohio State University, 1941; (1931 to 1971).

**†Corbett, Alan C.**
Associate Professor Emeritus of Animal Science and Veterinarian; B.S., University of Maine, 1936; M.S., ibid., 1937; D.V.M., Michigan State College, 1940; (1940 to 1978).

**Daggett, Albert F.**
Professor Emeritus of Chemistry; B.S., University of New Hampshire, 1928; M.S., ibid., 1930; Ph.D., Columbia University, 1934; (1928 to 1931, 1935 to 1976).

**Davis, Henry A.**
Associate Professor Emeritus of Analytical Services; B.S., University of New Hampshire, 1932; M.S., ibid., 1934, (1932 to 1976).

**Dawson, Charles O.**
Professor Emeritus of Civil Engineering; B.C.E., Ohio State University, 1930; M.S.C.E., ibid., 1940; (1930 to 1976).

**Degler, Carroll M.**
Professor Emeritus of Business Administration and Economics; A.B., University of Kansas, 1925; M.B.A., New York University, 1927; S.S., Columbia University, 1933; (1928 to 1973).

**Deichert, Lillian C.**
Associate Professor Emerita, Loan Librarian; A.B., Hunter College, 1933; M.L.S., Pratt Institute, 1960; (1964 to 1975).

**DeQuoy, Ruth W.**
Associate State 4-H Leader Emerita; B.A., New Hampshire College, 1921; M.Ed., University of Maryland, 1953, (1929 to 1965).

**Dunn, Stuart**
Professor Emeritus of Botany; B.S., University of Minnesota, 1923; M.S., Iowa State College, 1925; Ph.D., University of Minnesota, 1931; (1926 to 1970).

**Eggert, Russell**
Professor Emeritus of Horticulture; B.S., Michigan State College, 1929, M.S., ibid., 1939; (1942 to 1946, 1948 to 1970).

**Ellis, Elizabeth E.**
Extension Associate Professor Emerita of Home Economics; B.S., Teachers College, Columbia University, 1927; M.A., ibid., 1929; (1929 to 1960).

**Emery, Harvard B.**
Assistant Professor Emeritus of Graphics, Cert. in M.E., Lowell Institute, 1938; (1954 to 1978).

**Fernald, Mary L.**
Associate Professor Emerita of Nursing; B.S., University of New Hampshire, 1931; Dipl., Children's Hospital School of Nursing, 1935; M.A., Teachers College, Columbia University, 1947; (1964 to 1974).

**Granger, Ralph H.**
Assistant Director Emeritus, Thompson School of Applied Science, and Thompson School Associate Professor Emeritus of Applied Business Management; B.S., University of Massachusetts, 1935; M.S., ibid., 1939; (1946 to 1976).

**Haendler, Helmut M.**
Professor Emeritus of Chemistry; B.S.Ch.E., Northeastern University, 1935; Ph.D., University of Washington, 1940; (1945 to 1978).

**Hall, Harry H.**
Professor Emeritus of Physics; B.S., Union College, 1926; Ph.D., Harvard University, 1934; (1940 to 1969).

**Haslerud, George M.**
Professor Emeritus of Psychology; B.A., University of Minnesota, 1930; Ph.D., ibid., 1934; (1945 to 1972).

**Hitchcock, Leon W.**
Professor Emeritus of Electrical Engineering; B.S., Worcester Polytechnic Institute, 1908; (1910 to 1956).

**Hogan, John A.**
Professor Emeritus of Economics; A.B., Washington University, 1932; A.M., ibid., 1934; M.A., Harvard University, 1948; Ph.D., ibid., 1952; (1947 to 1974).

**Hoitt, Samuel W.**
Director Emeritus of Cooperative Extension Service and Professor Emeritus of Agricultural Education; B.S., University of New Hampshire, 1928; M.S., ibid., 1931; (Staff 1929 to 1970).

**Holden, John T.**
Professor Emeritus of Political Science; A.B., Wesleyan University, 1936; M.P.A., Harvard University, 1941; M.A., ibid., 1942; Ph.D., ibid., 1943; LL.D. (Hon.), Nasson College, 1958; (1947 to 1972).

**James, Jessee**
State Leader Emeritus, Extension 4-H Youth Development and Associate Professor Emeritus of Occupational Education; B.S., University of Georgia, 1937; M.S., ibid., 1951; (1957 to 1974).

**Johnson, G. Reid**
Associate Professor Emeritus of History; A.B., Muskingum College, 1916, M.A., Princeton University, 1920; Ph.D., University of Edinburgh, 1922; (1932 to 1963).

**Johnson, Richard E.**
Professor Emeritus of Mathematics; B.A., Intermountain Union College, 1934; M.A., University of Washington, 1938; Ph.D., University of Wisconsin, 1941; (1966 to 1978).

***Keener, Harry A.**
Dean Emeritus of the College of Life Sciences and Agriculture, Director Emeritus of the Agricultural Experiment Station, and Professor Emeritus of Animal Science; B.S., Pennsylvania State University, 1936; M.S., West Virginia University, 1938; Ph.D., Pennsylvania State University, 1941; (1941 to 1978).

**Kichline, Willam L.**
Professor Emeritus of Mathematics; B.A., Lehigh University, 1924; M.S., ibid., 1928; (1931 to 1974).

**Langer, Clarence A.**
Professor Emeritus of Plant Science and Extension Horticulturist Emeritus, Fruits; B.S., Michigan State University, 1933; M.S., ibid., 1948; Ph.D., ibid., 1952; (1962 to 1974).

**Lavine, Irvin**
Professor Emeritus of Chemical Engineering; B.S., University of Minnesota, 1924; Ph.D., ibid., 1930; (1948 to 1949, 1951 to 1965).

**Leavitt, Harold I.**
Superintendent of Properties Emeritus; B.S., New Hampshire College, 1921; M.Ed., University of New Hampshire, 1936; M.A., Columbia University, 1940; (1928 to 1966).

**Littlefield, Ralph B.**
County Agent Leader Emeritus; B.S., University of New Hampshire, 1927; (1940 to 1970).

**Marschner, Donald C.**
Professor Emeritus of Business Administration; B.A., Brown University, 1929; Ph.D., Columbia University, 1964; (1964 to 1975).

**Marshall, Thomas O.**
Professor Emeritus of Education; A.B., Colgate University, 1929; Ed.M., S.U.N.Y. at Buffalo, 1933; Ed.D., Harvard University, 1941; (1947 to 1973).

**Maynard, Max S.**
Professor Emeritus of English; B.A., University of British Columbia, 1937; (1946 to 1972).

**Meyers, T. Ralph**
Professor Emeritus of Geology; B.A., Ohio State University, 1926; M.A., ibid., 1929; (1927 to 1972).

**Milne, Lorus J.**
Professor Emeritus of Zoology; B.A., University of Toronto, 1933; M.A., Harvard University, 1934; Ph.D., ibid., 1936; (1948 to 1976).

**Morrow, Kenneth S.**
Professor Emeritus of Dairy Science; B.S., University of Minnesota, 1918; M.S., ibid., 1925; (1934 to 1966).

**Nast, Charlotte G.**
Professor Emerita of Botany; B.A., University of Wisconsin, 1927; M.A., ibid., 1929; Ph.D., University of California, 1938; (1948 to 1970).

**Owen, Margaret**
Assistant Professor Emerita, Order Librarian; A.B., Mount Holyoke College, 1919; (1943 to 1961).

**Partridge, Allan B.**
Associate Professor Emeritus of History; A.B., Clark University, 1922; A.M., ibid., 1923; (1925 to 1971).

**Petroski, Joseph J.**
Professor Emeritus of Education; B.A., University of New Hampshire, 1947; M.Ed., ibid., 1952; Ed.D., Harvard University, 1960; (1966 to 1978).

**Pew, Richard**
Associate Professor Emeritus of Hotel Administration; B.S., Cornell University, 1933; (1963 to 1974).

**Prince, Ford S.**
Professor Emeritus of Agronomy; B.S., University of Illinois, 1913; (1925 to 1957).

**Rand, M. Elizabeth**
Associate Professor Emerita of Home Economics; A.B., Wheaton College, 1930; M.Ed., Boston University, 1946; (1948 to 1973).

**Richardson, Edythe T.**
Professor Emerita of Zoology; B.S., New Hampshire College, 1922; M.S., University of New Hampshire, 1924; (1922 to 1966).

**Ringrose, Richard C.**
Professor Emeritus of Animal Science; B.S., Cornell University, 1932; Ph.D., ibid., 1936; (1942 to 1975).

**Sackett, Everett B.**
Dean Emeritus of the College of Liberal Arts and Professor Emeritus of Education; B.A., Hamline University, 1926; M.A., University of Minnesota, 1926; Ph.D., Columbia University, 1931; (1938 to 1967).

**Schaefer, Paul E.**
Associate Professor Emeritus of Zoology; A.B., Bethany College, 1926; M.S., Ohio State University, 1931; Ph.D., ibid., 1936; (1941 to 1971).

**Selberlich, Joseph E.**
Research Professor Emeritus, Engineering Experiment Station; Diploma Ingenieur, Technical University, Karlsruhe, Germany, 1924; Doctor Ingenieur, ibid., 1928; (1941 to 1962).

**Shimer, Stanley R.**
Professor Emeritus of Biochemistry; B.S., Muhlenberg College, 1918; M.S., Pennsylvania State College, 1923; (1924 to 1966).

**Skelton, Russell R.**
Professor Emeritus of Civil Engineering; B.S., Purdue University, 1924; C.E., ibid., 1934; S.M., Harvard University, 1939; (1928 to 1966).

**Slanetz, Lawrence W.**
Professor Emeritus of Microbiology; B.S., Connecticut State College, 1929; Ph.D., Yale University, 1932; (1932 to 1977).

**Stolworthy, Edward H.**
Professor Emeritus of Mechanical Engineering; B.S., Tufts College, 1922; D. Eng. (Hon.), University of New Hampshire, 1974; (1922 to 1968).

**Swan, Emery F.**
Professor Emeritus of Zoology; S.B., Bates College, 1938, Ph.D., University of California, 1942; (1952 to 1978).

**Swasey, Henry C.**
Associate Professor Emeritus of Intercollegiate Athletics; B.S, Amherst College, 1915; M.S., Indiana University, 1941; (1921 to 1962).

**Sweet, Paul C.**
Coach of Track and Cross Country and Professor Emeritus of Physical Education; B.S., University of Illinois, 1923; M.S., University of Southern California, 1941; (1924 to 1970).

**Thames, Sarah C.**
Associate Professor Emerita of Home Economics; B.S., Simmons College, 1930; M.S., Teachers College, Columbia University, 1942; (1945 to 1961).

**Thomas, George R.**
Professor Emeritus of the Arts; B.Arch., Carnegie Institute of Technology, 1930; (1930 to 1976).

**Tyrrell, Doris E.**
Associate Professor Emerita of Secretarial Studies; B.S., University of Minnesota, 1926; M.A., ibid., 1932; (1938 to 1966).

**Vreeland, Robert P.**
Associate Professor Emeritus of Civil Engineering; B.S., Yale University, 1932; M.S., Columbia University, 1933; M.E., Yale University, 1941; (1966 to 1977).

**Walsh, John S.**
Professor Emeritus of Languages; A.B., Harvard University, 1915; A.M., Boston University, 1928; D.H.L. (Hon.), University of New Hampshire, 1965; (1922 to 1962).

**Warren, Richard G.**
Professor Emeritus of Poultry Science, Extension Poultryman Emeritus; B.S., Cornell University, 1934; M.S., ibid., 1935; (1937 to 1970).

**Watson, Robert I.**
Professor Emeritus of Psychology; A.B., Dana College, 1933; A.M., Columbia University, 1935; Ph.D., ibid., 1938; (1967 to 1975).

**Webster, Robert G.**
Professor Emeritus of English; B.A., University of New Hampshire, 1926; M.A., ibid., 1930; (1927 to 1970).

**Woodruff, Ruth J.**
Professor Emerita of Economics; B.A., Byrn Mawr College, 1919; A.M., ibid., 1920; Ph.D., Radcliffe College, 1931; (1931 to 1967).

**Wooster, Caroline S.**
Associate Professor Emerita of Physical Education, Cert., Sargent School for Physical Education, 1926; B.S., University of New Hampshire, 1934; (1944 to 1970).

**Zimmerman, Oswald T.**
Professor Emeritus of Chemical Engineering; B.S.E., University of Michigan, 1929; M.S.E., ibid., 1931; Ph.D., ibid., 1934, (1938 to 1970).

## Faculty

**(with date of appointment)**

**Abeles, Sigmund M.** (1970)
Professor of the Arts; A.B., University of South Carolina, 1955; M.F.A., Columbia University, 1957.

**Abromson, Morton C.** (1972)
Assistant Professor of the Arts; A.B., Boston University, 1963; M.A., ibid., 1964, Ph.D., Columbia University, 1977.

**Adamovich, Frank W.** (1968)
Assistant Professor, Documents Librarian; B.S., Fitchburg State Teachers College, 1960; M.S., Simmons College, 1968.

**Adams, Robert L. A.** (1967)
Assistant Professor of Geography; B.A., Williams College, 1961; M.A., Clark University, 1966; Ph.D., ibid., 1971.

**Allmendinger, E. Eugene** (1958)
Associate Professor of Naval Architecture and Associate Director of Marine Program; B.S., University of Michigan, 1941; M.S., University of New Hampshire, 1950.

**Alonzo, Roy S.** (1969)
Thompson School Associate Professor of Food Services Management; B.S., Boston University, 1953; M.B.A., Western New England College, 1961; Ed.D., Nova University, 1978.

**Amell, Alexander R.** (1955)
Professor of Chemistry; B.S., University of Massachusetts, 1947; Ph.D., University of Wisconsin, 1950.

**Amidon, Jill Y.** (1978)
Instructor in Home Economics; B.S., Iowa State University, 1967; M.A., Columbia University, 1970.

**Amsden Katherine** (1967)
Associate Professor of Physical Education; A.B., Sweet Briar College, 1953; M.S., Smith College, 1956; Ph.D., University of Southern California, 1967.

**Anastasion, Cathy** (1978)
Lecturer in Theater and Communication; B.F.A., Rhode Island School of Design, 1974.

**Andersen, Kenneth K.** (1960)
Professor of Chemistry; B.S., Rutgers University, 1955; Ph.D., University of Minnesota, 1959.

**Anderson, Charlotte K.** (1943)
Professor, Assistant Librarian; B.A., University of Michigan, 1935; A.B.L.S., ibid., 1936; A.M.L.S., ibid., 1951.

**Anderson, Franz E.** (1967)
Associate Professor of Geology; B.A., Ohio Wesleyan University, 1960; M.A., Northwestern University, 1962; Ph.D., University of Washington, 1967.

**Anderson, Sheila B.** (1977)
Instructor in Occupational Therapy; B.S, University of North Dakota, 1970; M.S., Indiana University, 1978.

**Andrew, David S.** (1976)
Assistant Professor of the Arts; B.A., University of Michigan, 1965; M.A., ibid., 1968; Ph.D., Washington University, 1977.

**Andrew, Michael D.** (1966)
Associate Professor of Education; B.S., Cornell University, 1960; A.M.T., Harvard University, 1961; Ed.D., ibid., 1969.

**†Andrews, Richard A.** (1959)
Professor of Resource Economics; B.S., University of Maine, 1949; M.S., Pennsylvania State University, 1951; Ph.D., University of Minnesota, 1959.

**Annis, William H.** (1962)
Professor of Occupational Education; B.S., University of Maine, 1951; M.Agri.Ed., University of New Hampshire, 1959, Ed.D., Cornell University, 1961.

**Antonak, Richard F.** (1975)
Assistant Professor of Education; B.A., Rutgers University, 1969; M.Ed., Temple University, 1970; Ed.D., ibid., 1975.

**Antoslewicz, Rose T.** (1970)
Associate Professor of Italian; A.B., Brown University, 1954; Ph.D., University of California at Los Angeles, 1971.

**Arndt, Karl S. N.** (1966)
Lecturer in German and Resident Director, Salzburg Program; A.B., Brown University, 1960; M.A., University of Connecticut, 1963; Ph.D., ibid., 1966.

**Arnold, John F.** (1978)
Assistant Professor of Education; B.S., Washington and Lee University, 1957.

**Arnoldy, Roger L.** (1967)
Professor of Physics and Director of Space Science Center; B.S., St. Mary's College, 1956; M.S., University of Minnesota, 1959; Ph.D., ibid., 1962.

**Arredondo-Dowd, Patricia M.** (1978)
Assistant Professor of Education; B.S., Kent State University, 1967; M.Ed., Boston College, 1973; Ed.D., Boston University, 1978.

**Ashley, Charles H.** (1969)
Associate Professor of Education; A.B., Dartmouth College, 1957; M.Ed., University of New Hampshire, 1960; Ed.D., Boston University, 1969.

**Aultman, Dwight E., III** (1966)
Trainer, Physical Therapist and Assistant Professor of Physical Education; B.S., Medical College of Virginia, 1956.

**Babcock, Robert B.** (1977)
Assistant Professor of Education; B.A., University of Georgia, 1969; M.Ed., University of Georgia, 1971; Ph.D., University of Georgia, 1977.

**Bachelder, Anne** (1978)
Adjunct Assistant Professor of Nursing; Diploma, Concord Hospital, 1964; B.S.N., St. Anselm's College, 1968, M.S.N., Boston University, 1971.

**Baker, Alan L.** (1972)
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**Residential Life**
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# Enrollment Statistics—Fall Semester

| | 1975-1976 | 1976-1977 | 1977-1978 | 1978-1979 | 1975-1976 | 1976-1977 | 1977-1978 | 1978-1979 | 1975-1976 | 1976-1977 | 1977-1978 | 1978-1979 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Men** | | | | **Women** | | | | **Total** | | | |
| Freshmen | 1209 | 1109 | 1142 | 1102 | 1157 | 1136 | 1135 | 1224 | 2366 | 2245 | 2277 | 2326 |
| Sophomores | 1108 | 1072 | 1129 | 1114 | 1088 | 1082 | 1148 | 1149 | 2196 | 2154 | 2277 | 2263 |
| Juniors | 1105 | 1052 | 1023 | 1078 | 975 | 1038 | 1090 | 1096 | 2080 | 2090 | 2113 | 2174 |
| Seniors | 1027 | 1058 | 1067 | 997 | 902 | 972 | 1063 | 1127 | 1929 | 2030 | 2130 | 2124 |
| 1st Year—T.S.A.S. | 203 | 217 | 190 | 167 | 97 | 125 | 108 | 117 | 300 | 342 | 298 | 284 |
| 2nd Year—T.S.A.S. | 162 | 133 | 141 | 114 | 60 | 74 | 86 | 73 | 222 | 207 | 227 | 187 |
| D.C.E.—A.A. | 96 | 79 | 65 | 52 | 180 | 153 | 139 | 112 | 276 | 232 | 204 | 164 |
| Graduates—Master's | 484 | 501 | 442 | 379 | 253 | 321 | 331 | 327 | 737 | 822 | 773 | 706 |
| Graduates—Doctorates | 146 | 175 | 166 | 146 | 45 | 51 | 57 | 51 | 191 | 226 | 223 | 197 |
| **Total** | **5540** | **5396** | **5365** | **5149** | **4757** | **4952** | **5157** | **5276** | **10297** | **10348** | **10522** | **10425** |
| Extension Credit Courses | 765 | 716 | 741 | 658 | 800 | 841 | 912 | 869 | 1565 | 1557 | 1653 | 1527 |
| Summer Session† | 1421 | 1460 | 1384 | 1554 | 1677 | 1799 | 1771 | 1988 | 3098 | 3259 | 3155 | 3542 |
| **Baccalaureate Curricula** | **Life Sciences and Agriculture** | | | | **Liberal Arts** | | | | **Engineering & Physical Sciences** | | | |
| Senior | 435 | 437 | 466 | 433 | 778 | 794 | 741 | 777 | 219 | 262 | 303 | 335 |
| Junior | 420 | 450 | 427 | 396 | 828 | 768 | 795 | 774 | 273 | 302 | 316 | 391 |
| Sophomore | 417 | 363 | 381 | 316 | 922 | 922 | 927 | 991 | 311 | 353 | 418 | 411 |
| Freshman | 382 | 356 | 328 | 355 | 1010 | 933 | 960 | 1004 | 450 | 451 | 471 | 483 |
| **Total** | **1654** | **1606** | **1602** | **1500** | **3538** | **3417** | **3423** | **3546** | **1253** | **1368** | **1508** | **1620** |
| **Baccalaureate Curricula** | **Whittemore School** | | | | **Health Studies** | | | | | | | |
| Senior | 315 | 326 | 369 | 346 | 182 | 211 | 251 | 233 | | | | |
| Junior | 355 | 363 | 352 | 381 | 204 | 207 | 223 | 232 | | | | |
| Sophomore | 309 | 271 | 319 | 318 | 237 | 245 | 232 | 227 | | | | |
| Freshman | 268 | 252 | 266 | 238 | 256 | 253 | 252 | 246 | | | | |
| **Total** | **1247** | **1212** | **1306** | **1283** | **879** | **916** | **958** | **938** | | | | |
| **Graduate Curricula*** | **Graduate School** | | | | | | | | | | | |
| †Master's | 737 | 822 | 773 | 706 | | | | | | | | |
| Doctorates | 191 | 226 | 223 | 197 | | | | | | | | |
| **Total** | **928** | **1048** | **996** | **903** | | | | | | | | |
| **Associate Degree Curricula*** | **Thompson School** | | | | **Division of Continuing Education** | | | | | | | |
| 2nd Year | 222 | 207 | 227 | 187 | | | | | | | | |
| 1st Year | 300 | 342 | 298 | 284 | | | | | | | | |
| **Total** | **522** | **549** | **525** | **471** | **276** | **232** | **204** | **164** | | | | |

†Does not include Institutes and Special Summer Session in Technology.
*Graduate Curricula and Associate Degree Curricula should not be confused with any particular "college" column; they are separate entries.

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